Western Australia

SUPPLEMENT

TO THE

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

of Western Australia.

MARCH, 1949.

By Direction of
The HON. THE MINISTER FOR AGRICULTURE.

INDEX, VOLUME 25, 1948.

44725

PERTH:
BY AUTHORITY. WILLIAM H. WYATT, GOVERNMENT PRINTER.

1949

25107/49

Supplement to the Journal of the Department of Agriculture of Western Australia.

March, 1949.

INDEX.

Vol. 25, 1948.

SUBJECT INDEX.

INDEX—*continued.*

INDEX—*continued.*

AUTHORS' INDEX.

INDEX—*continued.*

By Authority: WILLIAM H WYATT, Government Printer, Perth.

JOURNAL
OF THE
Department of Agriculture
OF
WESTERN AUSTRALIA

Vol. 25. (Second Series) MARCH, 1948 No. 1

ROYAL SHOW 1947

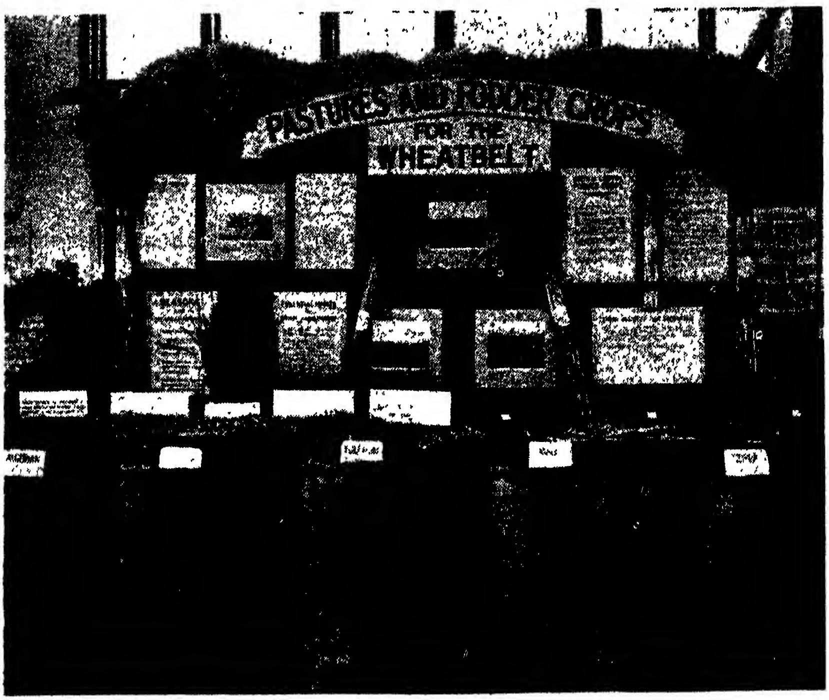
DISPLAY OF THE DEPARTMENT OF AGRICULTURE.

The 1947 Royal Show Exhibit was organised by Mr. G. R. W. Meadly, who prepared the following article based on information supplied by the various branches.

The exhibit at the 1947 Royal Show prepared by the various branches demonstrated the great diversity in agriculture in Western Australia, the variety of products and the problems of the man on the land. It also directed attention to the many aspects being investigated by the Department and the range of subjects concerning which advice is obtainable.

Naturally only a small proportion of the farming community was able to attend the show and examine the exhibits but a pictorial record has been prepared which, along with brief descriptions, will convey some impression of their nature.

A display devoted largely to stock husbandry in the wheat belt along with the production of cereal crops was prepared by the Wheat Branch. The exhibit covering stock husbandry was centred around the export lamb industry. By the use of photographs, the several stages in the production of prime export lambs were shown including the breeding of the crossbred ewe from the mating of long wool English rams with the Merino ewe, and the production of the prime carcase resulting from the mating of the Southdown ram with one or other types of the crossbred ewe. In order to produce prime lambs it is essential that the feeding of both the lamb and the ewe be efficient and nutritious.



Supplementing the lamb exhibit was a display illustrating, by medium of photographs, posters and actual pasture exhibits, the recommended pasture mixtures and fodder crops for wheatbelt conditions. It was also shown that in addition to improved pastures being necessary for maximum stock production, they are essential for the building up and maintenance of the soil fertility and play no small part in soil conservation. Legumes have an important place in improved pastures.

In addition to providing good pastures and fodder crops, it is also essential to conserve adequate fodder for the lean periods of the year. The main reasons for conservation and suitable types of fodder were set out in the appropriate placards.

The growing of barley, particularly for malting, is of considerable importance in some areas of the wheatbelt, and information was provided concerning varieties and requirements for good malting grades.

The production of pedigree seed wheat, oats and barley, is a major operation of the Wheat Branch and the system of pure line breeding of such seed was graphically illustrated, showing that the seed distributed to farmers is never more than a few years away from single plants, which ensures purity of the seed distributed.

The desirability of farmers obtaining regular supplies of pedigree seed for planting stud plots on their own properties was stressed and bags of graded seed of the recommended varieties of wheat, oats and barley were displayed around the base of the stand. Interspersed between the placards and photographs were sheaves of the recommended varieties of cereals bearing cards describing their main characteristics. Small samples of some of the varieties of minor importance and newly produced or introduced varieties were also displayed.

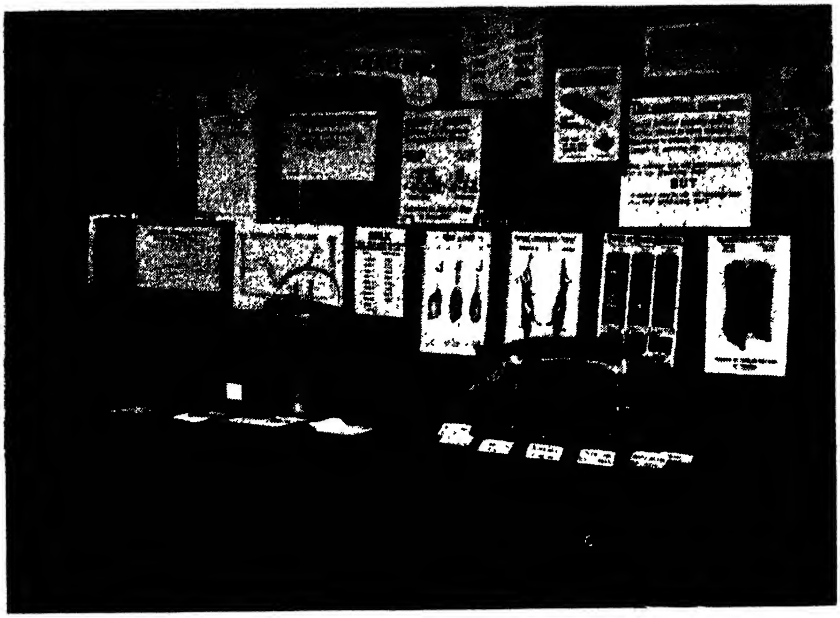
Wheatbelt agriculture is primarily based on wheat growing and the recommended methods for, and times of carrying out, the various cultural operations were graphically illustrated by placards and the use of photographs showing modern implements in operation.

In order to acquaint farmers with the correct time for planting the different cereals in each district, seeding calendars for the three rainfall zones of the wheatbelt were displayed. These calendars illustrate the optimum seeding periods and the different maturities of the recommended varieties.

The exhibit prepared by the sheep and wool adviser included a display of Merino fleeces from a number of important wool districts, together with cards giving figures concerning sheep population and wool production and values during the past ten years.

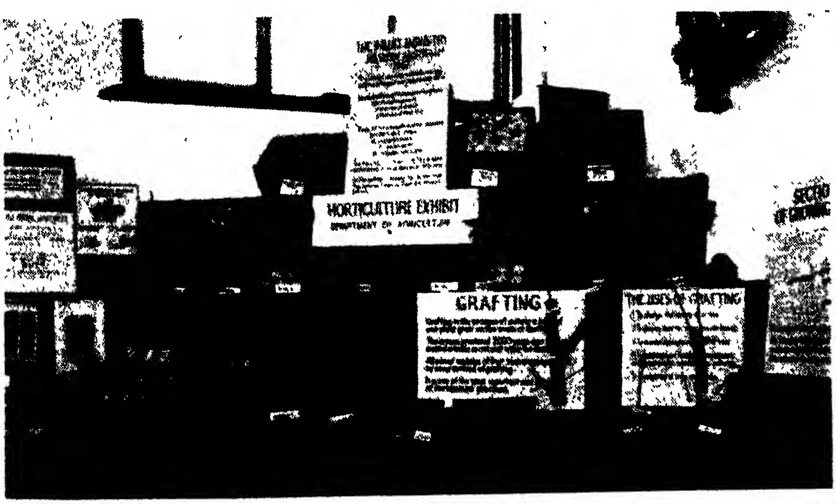
The remarkable responses to copper supplements ranging from 0-20 mg. per day were demonstrated by a series of eight Merino fleeces. Visual evidence was supported by information concerning improvement in both quality and yield following the usage of copper in a deficient area.

Maps and cards were utilised to show the wool producing, buying and consuming countries in the world together with sheep population, wool consumption per head of population, etc., for these countries. Stages in manufacture from raw wool to the finished fabric were depicted with stress on the valuable characteristics of pure wool for the manufacture of textile fabrics.



The display of the Dairy Branch dealt with both primary and secondary aspects of the industry. Various species of plants utilised for forage purposes were exhibited. Besides butter, ice-cream and condensed milk produced by local manufacturers, the display also included various by-products of milk and the manner in which they are employed for the manufacture of many commercial products.

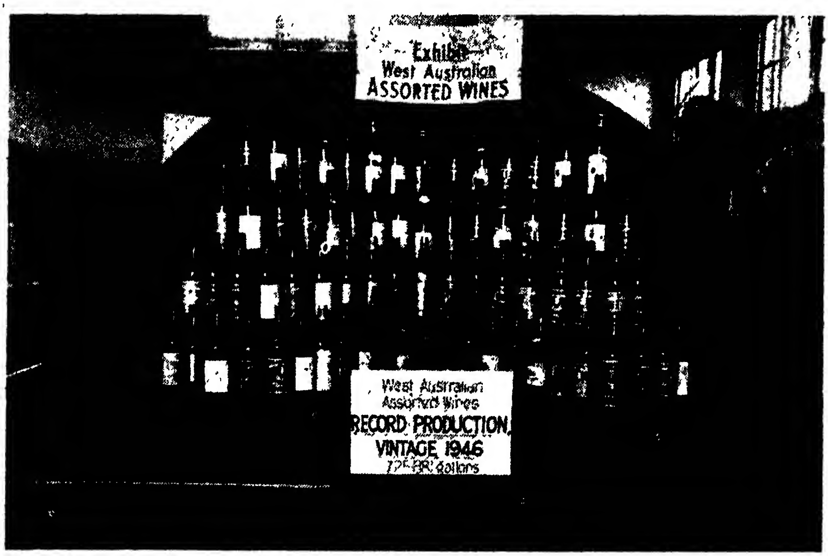
The section of the exhibit shown above emphasises the importance of grade herd recording in improving production in herds throughout the State and illustrates the equipment used in the Babcock test which is employed for determining the percentage of butterfat in milk. The model pig depicted the ideal baconer while both desirable and undesirable types of carcases were shown on the wall cards.



The exhibit of the Horticultural Branch showed the various types of fruit of main commercial importance in Western Australia with the exception of tropical fruits. A collection of the different types and varieties of citrus and pome fruits was displayed, together with general statistics pertaining to the fruit industry.

The export of both apples and citrus being of particular importance at the present time, examples were shown of cases of these two fruits packed for the export trade.

In a section of the display set aside for instructional purposes, examples of various types of fruit tree grafts were shown. Explanatory posters were attached to this section giving technical and general details concerning the procedure.



The viticultural display was exhibited by the Western Australian Wine Makers' Association and consisted of a very attractively labelled and arranged display of all commercial types of wine.

Geographically Western Australia is well situated for the production of many kinds of high class fruit, including the grape. It possesses a huge expanse of country adjacent to the coast assured of the rainfall necessary to produce luxurious vine growth and associated high quality grapes.

The long sunny summers mature the grapes to practical perfection, thus originating high flavours and characters, combined with high specific gravity which are conducive to the production of quality wines. Wines from Western Australia are at least the equal of those from other States, a feature that has been demonstrated on more than one occasion in recent years, by winning championships and other awards.

The display included production figures for recent years showing that the 751,447 gallons produced in 1946-47 approximated the record for any one season.

The main feature of the Vegetable Branch exhibit was a sample of vegetables as packed for overseas export. Emphasis was given to this aspect because, with the rapidly expanding export trade, close attention must be given to quality and type of vegetables, suitable containers and correct marking and packing.

Charts illustrating the value of these markets were displayed, showing an increase in overseas export from £2,000 in 1938-39 to £348,000 in 1946-47.

Collections of fresh vegetables illustrated the most desirable features of better known varieties and typified results of present day methods of vegetable culture. The importance of fresh vegetables in our diet was stressed by cards showing the relative value of each with regard to its vitamin, mineral and energy content.

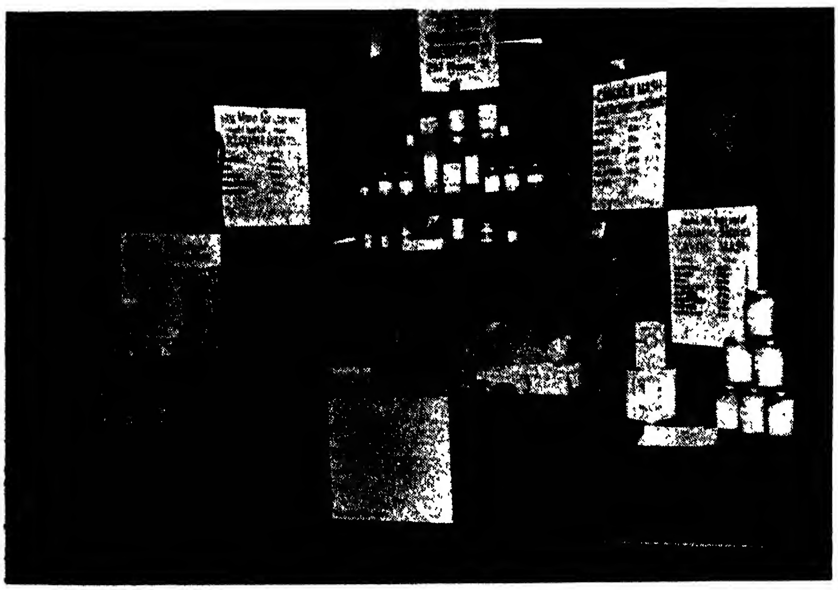
"Don'ts" in potato harvesting and recommendations for guarding against potato moth in storage were displayed. A sample of potatoes which complied with grade 1 standard was contrasted with one below the requisite grade specified by the State potato grading regulations.

The sides of a triangular stand were utilised by the Apiculturist to display three aspects of the honey industry. One side was used to show honey in glass jars in the commercial sizes along with a number of fancy jars and two fully capped full-depth frames and one half-depth frame of honey.

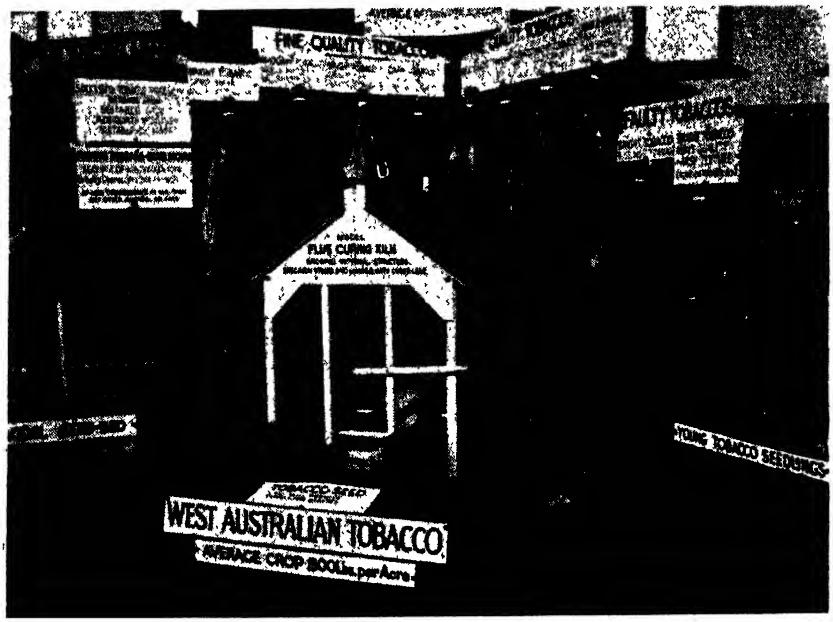
The South Australian two-decker hive and attachments which received the first prize awarded at the Victorian Beekeepers' Conference were displayed on another side. Resting on the top of this hive was a two-decker observation hive surmounted by a single frame observation hive of honey and bees.

The remainder of the stand was occupied by two frames, showing brood diseases, one of American foul brood and the other of European foul brood; fancy jars of honey vinegar and several cakes of natural yellow beeswax; show-cases of pests and parasites that attack bee colonies and a number of different methods of wiring frames. A kookaburra moulded in beeswax capped the exhibit.

As shown above, one section of the Poultry Branch exhibit was prepared with a view to firstly demonstrating to producers the type of egg acceptable to the Department of Commerce for export and the advantages of producing clean eggs. Secondly, to sponsor local sales by demonstrating to the consumer measures that are taken to ensure that only first quality eggs are distributed for local consumption.



Male and female chickens of the auto-sexing Legbar breed of fowls were contained in two small model brooders. These chickens were bred at the Muresk Agricultural College from parent stock imported from England. When this stock has been tested thoroughly, it is hoped to distribute it to the industry. Samples of the different feeding materials obtainable in Western Australia were shown and balanced rations suggested for chickens and laying birds. Some poultry medicines and instruments were also displayed.



The central feature of the Tobacco Branch exhibit was a scale model of a tobacco flue curing kiln showing the internal structure, heating and ventilating arrangements, and sticks loaded with cured leaf.

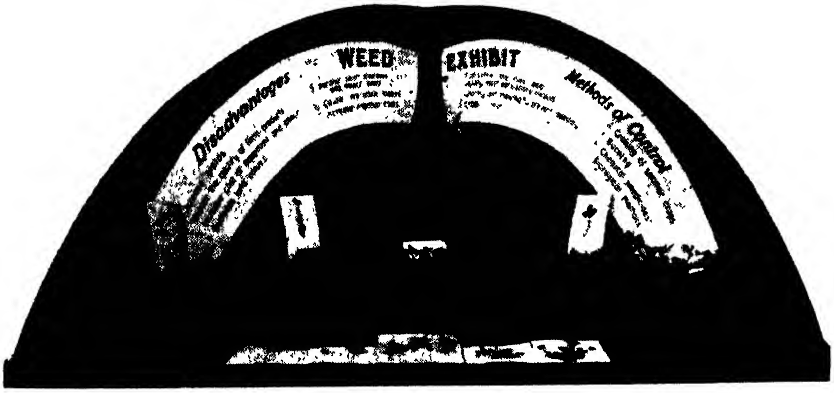
On either side were model seed beds with tobacco seedlings in different stages of growth. Suspended behind the curing kiln were "hands" of tobacco leaf of various grades marked with the prices obtained at the last series of appraisements along with some "hands" showing the effect of "blue mould" disease.

The Plant Pathology exhibit dealt with diseases of cereals, vegatables and fruit caused by both parasitic and non- parasitic agencies. Growing plants were used to demonstrate the effect of pure culture inoculation on the growth of subterranean clover and barrel medic and also the effect of seed protectant dusts on the emergence (germination) of garden peas.

As a direct result of pre-sowing seed inoculation with appropriate rhizobial strains the growth of subterranean clover and barrel medic was increased manifold. Dusting Massey pea seed with Spergon (Tetroc) prior to sowing in old nursery soil increased plant emergence from 5 per cent. to 85 per cent.

The Botany exhibit was devoted entirely to weeds. Growing specimens of hoary cress, St. John's wort, Cape tulip, bind-weed, double gee and water hyacinth were displayed while the pressed material included Bathurst burr, star thistle, Berkheya thistle, caltrop and Paterson's curse.

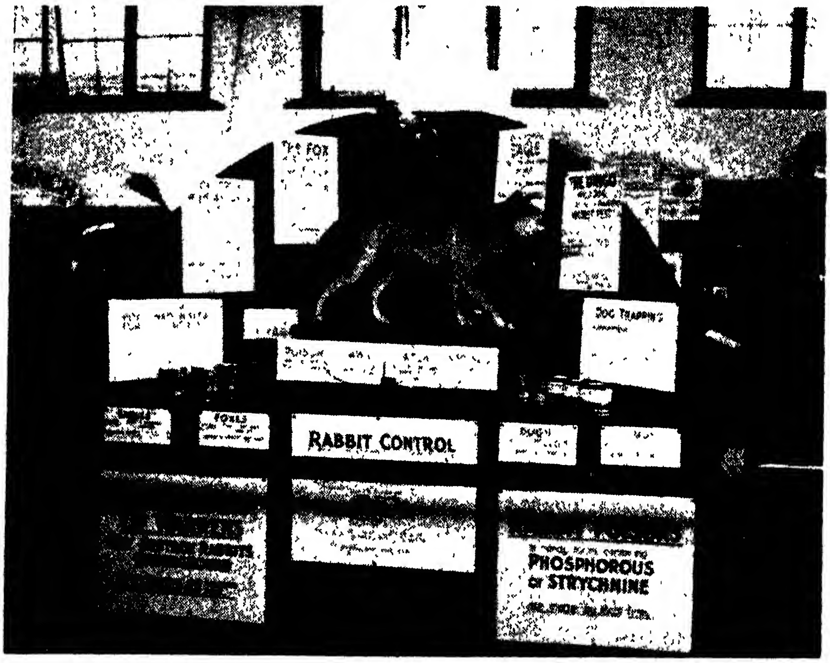
The many disadvantages associated with weeds were listed along with the main methods of control.



The Vermin Branch exhibit drew attention to the methods of vermin destruction and the necessity for action especially against rabbits, wild dogs, foxes, eagles and emus.

Samples of rabbit poisoning materials were displayed and also a dingo trap with captions indicating its main features and preparation prior to setting.

Mounted specimens of the wedge-tail eagle and dingo respectively occupied prominent positions in the exhibit. Details of the numbers destroyed and bonus payments from the Vermin Act Trust Fund made for the various types of vermin during 1946-47 were indicated on cards. Such payments totalled approximately £22,500 for 14,000 wild dogs, 34,000 foxes, 4,000 eagles and 8,800 emus.



The photographic exhibit prepared by the Soil Conservation Service was arranged to depict some phases of soil erosion in Western Australia and some of the methods now used to control and prevent erosion and improve soil fertility.

One part of the exhibit, a group of ground photos (Fig. 1), showed aspects of erosion and control in Western Australia with emphasis on the value of pasture. The landscape in hilly country is at the Muresk Agricultural College. This area was actively eroding, but has been stabilised by pasture for several years. In preparation for future cropping some of this steep land has now been laid out in a system of graded banks such as those shown in Fig. 3. Such a system shortens the length of run off directly downhill and carries excess water slowly off the paddock with far less soil movement. This mechanical protection to the soil is,

however, only complementary to the great improvements in soil condition and capacity to absorb water rapidly, which can be expected following a period under good pasture. These are prime factors in preventing erosion.

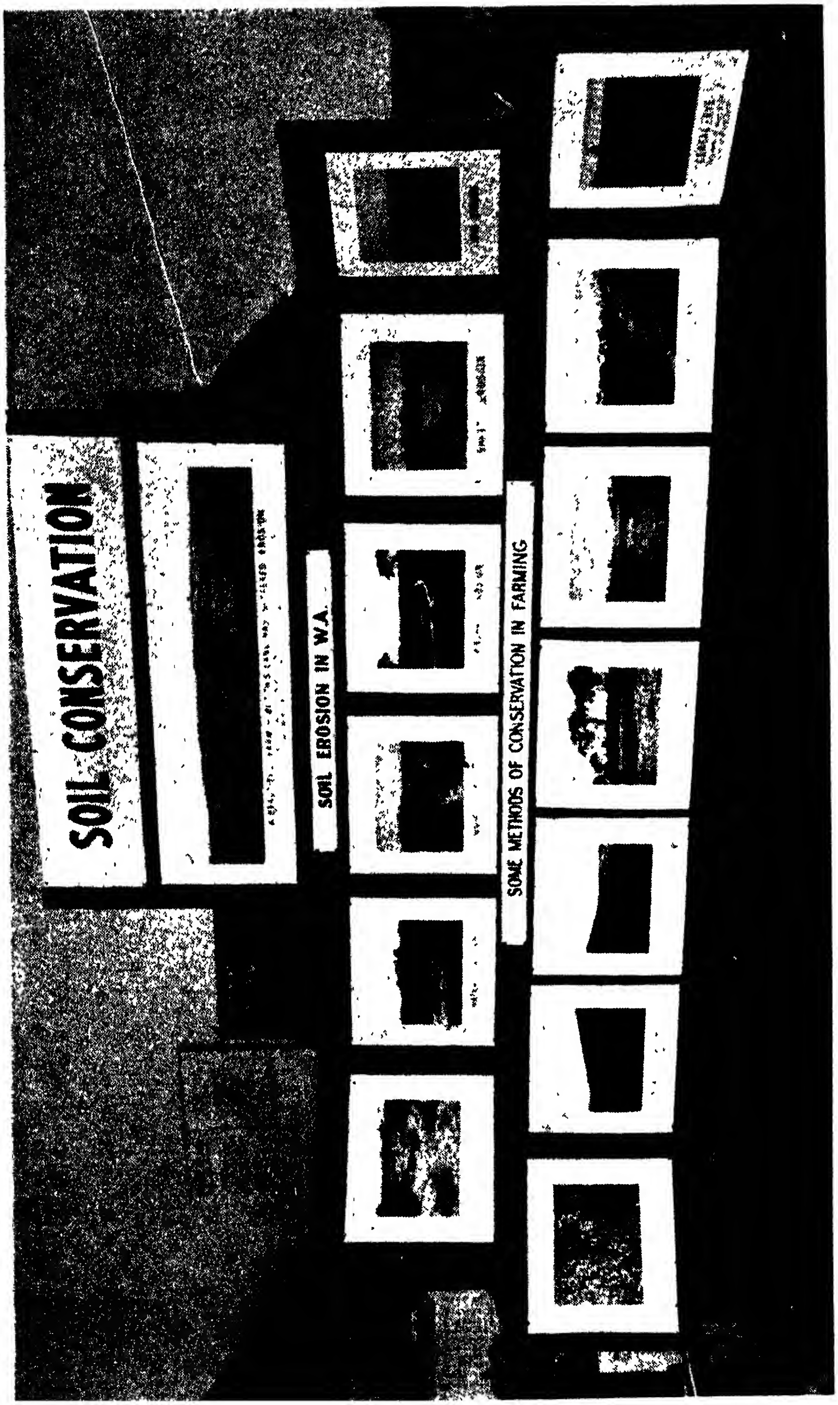


Fig. 1

Three groups of aerial photographs formed the second part of the exhibit (Figs. 2, 3 and 4.) Aspects of water erosion in Western Australia (Fig. 2) were demonstrated, particularly the tendency of uncontrolled gullies to branch and make

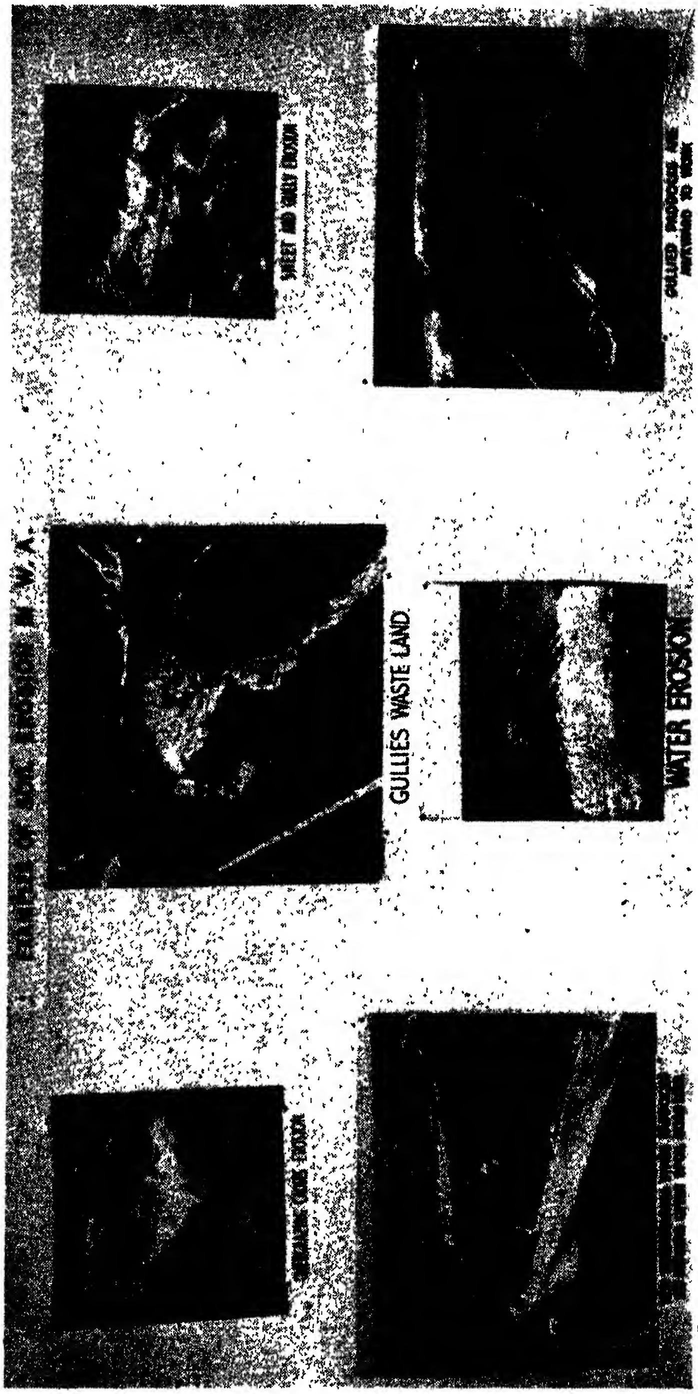


Fig. 2.

paddocks costly to work. Methods of conservation farming shown in Fig. 3 are —(i) systems of graded banks; (ii) contour working (at bottom on right); (iii) one phase of gully control; (iv) an indication of the future pattern of farming

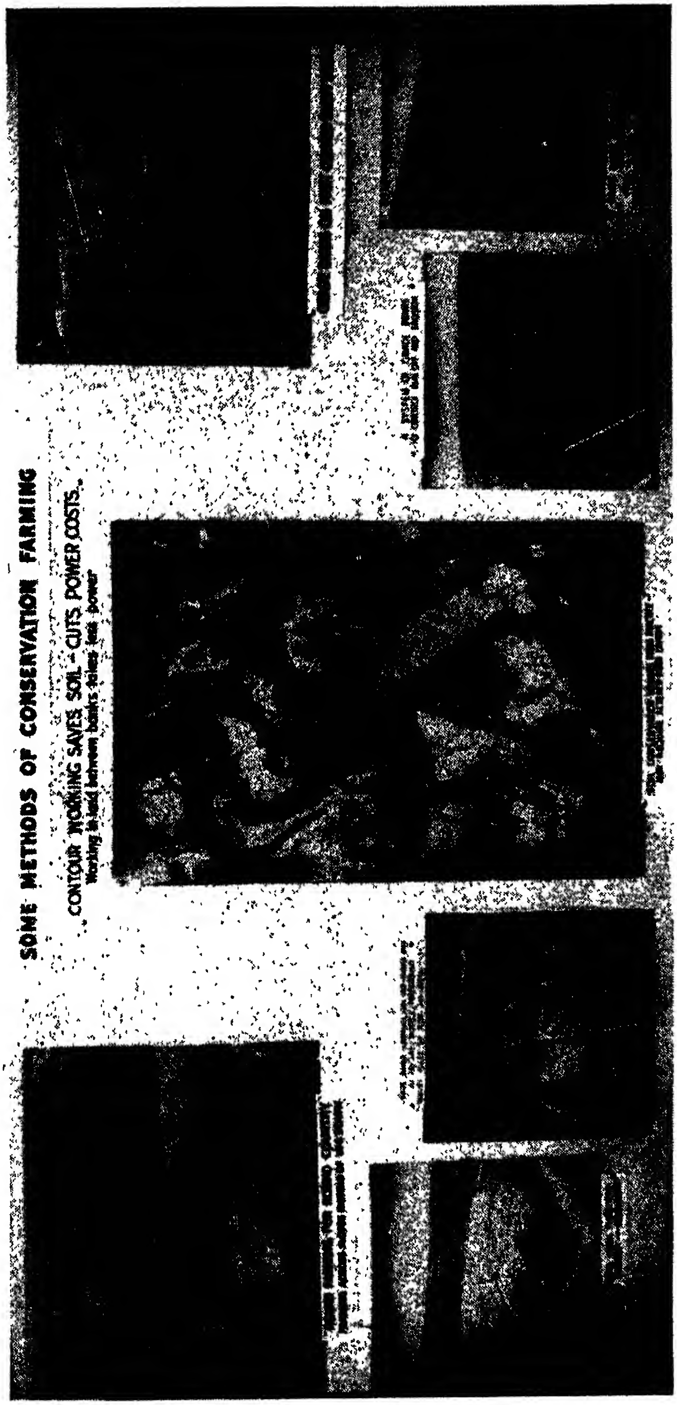


Fig. 3.

where soils, slopes and rainfall dictate the need for contour farming, with or without systems of banks; and (v) a hint of the possible need for alterations in farm layout.

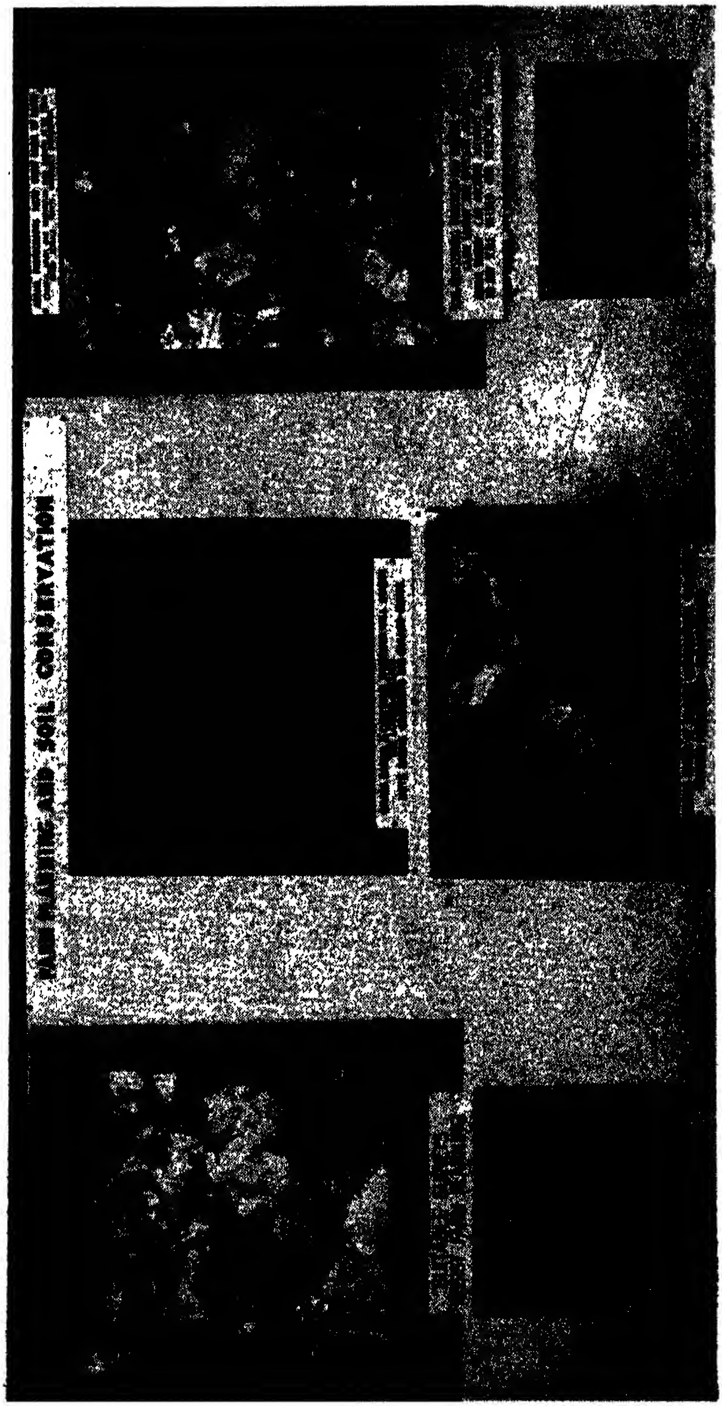


Fig. 4.

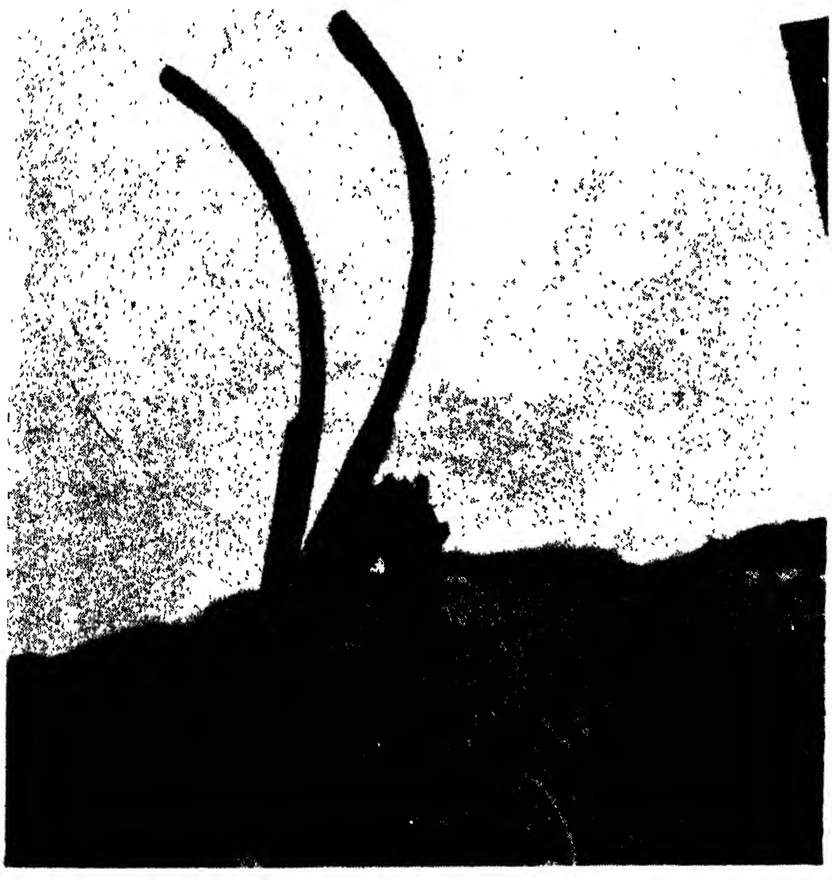
The pavilion also contained exhibits prepared by the Stock and Entomology Branches but unfortunately photographs of these could not be obtained.

The aerial photographs are the work of the Kingsley Watson Aerial Photographic Survey Unit and several are published by courtesy of Mr. Kingsley Watson. The remainder of the photographs used in this article were prepared by the Government Printer.

A Handy Aid to the Clearer

by V. B. MONTI, Dairy Supervisor.

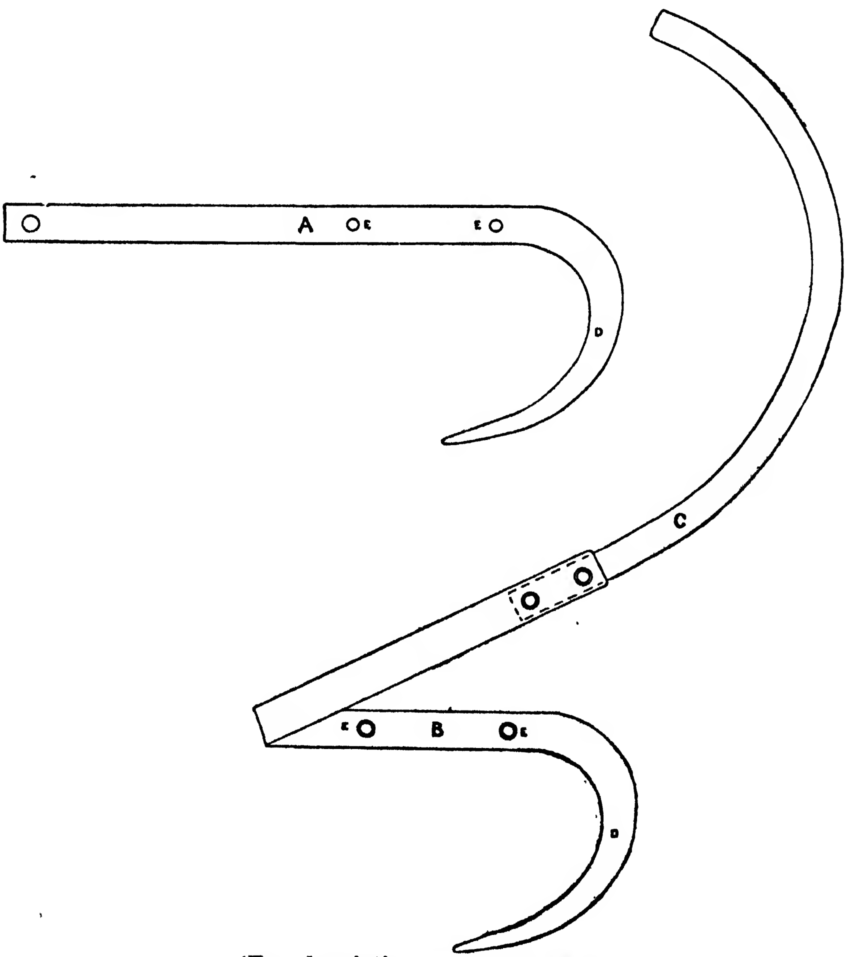
THE implement illustrated was invented and developed by Mr. Cedar Armstrong, of Bramley. The second aid is a quiet horse with the ability to pull steadily and straight without swing. With this combination it is possible to make up to 100 pulls an hour on re-growth varying from an inch to 3 inches in diameter. The best results are obtained after the soil has received a good soaking with the winter rains.



The device consists of a central beam of $\frac{1}{2}''$ x $1\frac{1}{4}''$ spring steel terminating in a pointed foot similar to an elongated cart hook. To either side of this is welded a similar foot with a shorter beam, the feet being off set slightly so that there is a space of an inch between each of the three prongs at the points. Inch by three-eighth inch upswept iron handles welded or bolted on to the beam and ring to attach the snig chain completes the device. Two old rubber inflations on the ends of the handles will save the hands a lot.

The setting of the beam and the angle on the bottom of the foot is important for it is necessary that, when the power is applied, the implements tends to dig itself in rather than lift out. The points should be made sharp and kept in that condition.

It is used by merely placing it a few inches to the rear of the plant required to be extricated. When used against a small sapling the machine is held slightly sideways to clear the handles. If the diameter of the sucker is small it will tend to wedge between the claws as in drawing a nail with a hammer, and if larger two or more of the claw points will dig into it providing a firm hold. If the teeth tend to spread a clamp may be affixed not less than six inches from the points.



(For description see next page.)

The ease and speed with which this handy little device may be used after a little practice should commend it to any person with clearing or cleaning up re-growth to do. The same principle with the claws set wider apart and a duck foot type of point is suitable for pulling rushes and sword grass in creeks and swamps.

A. Centre beam (½″ x 1¼″ spring steel) has an overall length of 2′ 6″ measured on the outside curve. It is straight for 1′ 5″ from the front end, then curves in such a manner that the points are brought back under the beam opposite a point 1′ 2″ from the front end, the points are then 6½″ below the underside of the beam. The snig chain (approximately 6′ long) is attached to the ring at the front end of the beam.

B. Illustrates one of the two side pieces which are welded or riveted to the centre beam "A." These are 2′ 4″ overall length to the junction of the handles; or, 1′ from the end to the junction with "A," and 1′ 4″ from there to the point, measured on the outside of the curve. The three points should be not more than 1″ apart, and should gradually come together in the manner of a claw hammer at least 6″ back from their tips. These side pieces are also of ½″ x 1¼″ spring steel, and the ends to which the handles are attached are slightly off set from the centre beam so that the handles will be about 9″ apart at the tips.

C. Curved handles (1″ x ⅜″ steel) attached to the side pieces, 2′ 2″ overall length including the joint and measured on the outside curve. The ends of the handles are 2′ 6″ above the points, and are 6″ behind the perpendicular from the points when the machine is held in its normal position.

D. Curves terminating in points.

E. Holes for riveting frame together.

Waters for Agricultural Purposes in Western Australia

Officers of the Department of Agriculture and the Government Chemical Laboratories.

Water for Stock.

THE nature of water which stock will drink varies greatly with circumstances and conditions. In this State, the variation between the summer and winter salinity of the same water supply may be very great, and if stock have been accustomed to watering from one source the gradual increase of salinity which occurs with increasing summer concentration, may pass unnoticed by the animals, who become accustomed to it and suffer little ill effects. If, however, stock which have been accustomed to drinking fresh water, are suddenly put on to a very salt supply, it may be quite distasteful to them, and they may either refuse to drink it or suffer ill effects from its use. Stock, if thirsty through travelling, or under extreme conditions may take and thrive for a short period on a very saline water from which they would suffer if used continuously.

Such factors as these make the question more complicated than at first appears, and although certain standards of composition are recorded, their application cannot be entirely rigid. Water containing less than 300 grains total salts per gallon can be used continuously by all farm livestock. Sheep can tolerate water which is much more saline than that suitable for cattle, and cattle are more resistant than horses and pigs.

The safe upper limits of total salts in water for stock at present in use in this State are:—

	Grains per Gallon.
Poultry	200
Pigs	300
Horses	450
Cattle (Dairy)	500
Cattle (Beef)	700
Sheep	900

(437.5 grains = 1 oz.)

When the total salts exceed these amounts, only practical tests will show whether the water can be used without ill effect, because varying conditions vary the allowable maximum amount of soluble salts.

Where green feed is available, the animals can tolerate more saline water than when "bush or scrub" is the only feed. Sheep have been known to live on water containing up to 1300 grains per gallon of total salts for short periods, but success cannot be forecast with water so saline. Further, older and dry sheep can tolerate waters more saline than can young, growing sheep (weaners) or breeding ewes, and similarly for other stock. Horses not at work can be kept alive on a more saline water than can horses at work.

As indicated in the table, dry or beef stock can tolerate a more salty water than can milking cows, but the milk production of high yielding milking cows will be adversely affected by much lower salt concentrations than 500 grains per gallon.

Although a water may be too saline for use alone, it may be mixed with good water to lessen the drain on the good supply, e.g. when water carting is necessary. The proportions for mixing can be calculated from the soluble salts content of the two waters.

Mixing with a fresh water is the only practical and economic method at present available for utilising saline waters.

Water for Irrigation.

The use of water for irrigation and domestic gardens is influenced not only by the amount of saline material dissolved in the water, but also by the type of soil and drainage, the climate and the rainfall. Much of the unsuitability of saline waters is due to the accumulation in the soil of the salts from the water applied.

The following remarks should therefore be taken only as a general guide, and it is emphasised that where the waters approach the maximum salinity for particular plants or where there exists special conditions of drainage, soil types, rainfall, etc., only practical tests will indicate the suitability of the water for the use in question. A more saline water can be used successfully on a well-drained light soil than on a poorly drained heavy soil. Similarly a more saline water can be used in districts of high, though seasonal, rainfall, as the rain washes down the salts accumulated in the soil.

In general, where the drainage is good, water containing up to 70 grains total salts per gallon is suitable for growing all types of plants, including the salt susceptible plants.

Water containing up to 150 grains total salts per gallon, is suitable for growing most plants other than those susceptible to salt. Water containing up to 220 grains total salts per gallon, has been used for growing tomatoes, lucerne and cabbage and other salt resistant plants.

Above these limits, care should be taken to observe closely the growth and condition of plants or herbage, and if considered necessary, to obtain advice from the officers of the Agricultural Department.

Generally, however, 220 grains of total salts per gallon is regarded as approaching the maximum for safe watering of any plants. With such salt content, the drainage should be excellent and each watering should be of sufficient quantity to leach accumulated salts to a level below the root zone.

In the case of nearly all underground waters, it is advisable to apply by furrows or by flooding rather than by sprinkling.

Salt tolerant plants.

Asparagus, beetroot, cabbage, cauliflower, celery, couch grass, cucumber, lucerne, mangels, melons, pumpkins, rhubarb, silver beet, tomatoes, Wimmera Rye grass.

Salt susceptible plants.

Apricots, carrots, citrus, French beans, grape vines, maize, parsnips, peach, peas, potatoes, radishes, and seedlings.

General.

1. For general domestic use and for human consumption on individual farms the safe upper limit of total soluble salts is considered to be 150 grains per gallon. Water containing up to 300 grains per gallon may be used for showers and baths especially if a salt water soap is used, and water containing up to 700 grains per gallon may be used in a septic tank system.

2. Acid waters have a rapid corrosive effect on iron, such as pipes and tanks, and acidity should be corrected by the addition of good quality builders lime.

3. Acid waters may contain iron in solution and the addition of lime to correct the acidity will throw this iron out of solution as a sludge, which should be allowed to settle and the clear water used.

4. Water may contain sulphuretted hydrogen, a poisonous gas with a very objectionable odour similar to that of rotten eggs. This gas can be removed by aerating the water, the most convenient method usually being to allow the water to splash freely into the tank.

5. The clearing of muddy water by settling can be assisted by the use of kopi, powdery gypsum, at rates up to 4 lbs. per 1,000 gallons of water, or by the use of good quality builders lime at rates up to 4 ozs. per 1,000 gallons.

Samples of water for Stock, Irrigation and Domestic purposes, are analysed by the Government Chemical Laboratories, Adelaide Terrace, Perth, on compliance with the following: —

1. Each sample should:
   - (a) be approximately one pint of water in a clean container which has been previously rinsed with the water to be tested.
   - (b) be clearly marked with the sender's name and address;
   - (c) be securely packed and addressed as above.

2. At the same time, a letter should be forwarded stating:—
   (a) that the applicant is a bona fide farmer, market gardener, grazier, etc., and that the analysis is required in connection with his business as such;
   (b) the source of the sample e.g. bore, well, spring, etc., and its depth, and the location number of the property from which the sample was obtained;
   (c) enclosing the fee of 5s. per sample. This fee applies only to those who qualify under paragraph 2 (a), otherwise the fee is 15s. per sample.

Should the analysis be required very urgently, this should be stated in the letter and the cost of a telegram added to the fee, when a telegram will be sent immediately the analysis is completed.

CAPE TULIP.

G. R. W. MEADLY.
Assistant Government Botanist.

SUMMARY.

Two species of Cape tulip, *Homeria collina* (Thunb.) Vent.* and *H. miniata* Sweet, native to South Africa, are now serious weeds in many parts of Australia. They were introduced originally as garden plants.

Both species are toxic, all parts of the plant being harmful, both when green and dry. A glucoside and an alkaloid have been isolated from different species of Homeria.

Stock accustomed to grazing on areas infested with Cape tulip are seldom affected, probably because they avoid the plant. The most serious losses have been experienced among animals brought from a district free of Cape tulip to one in which this weed occurs in quantity.

Chemical sprays have not proved very successful and the most effective control measures are grubbing and ploughing. The time for carrying out these operations is governed not so much by the seeding of the weed as the formation of new corms and cormils. This usually commences at the beginning of August.

INTRODUCTION.

Cape tulip is the name applied to *Homeria collina* (Thumb.) Vent.* and *H. miniata* Sweet, two species which are widespread in this and other States of Australia. Both are native to South Africa where several other species also occur.

As early as 1859 *H. collina* was catalogued as a garden subject in the Adelaide Botanical Gardens and by 1890 both species were established as weeds in South Australia, Victoria, and Western Australia. Their appearance in New South Wales followed shortly after that date.

Cape tulip provides one of many examples of a plant introduced for ornamental purposes soon becoming a serious weed. It has been declared a noxious weed for the entire State.

* Probably more correctly *H. Breyniana.*

Although the extent of infestation in some districts makes eradication impossible, much can be done to control Cape tulip in those areas. Where only small, isolated patches occur, however, complete eradication can be effected. Early recognition followed by prompt action can prevent a few plants from originating a heavy infestation.

A. Homeria miniata. Two-leaved Cape Tulip.
B. & C. Homeria collina (C. seed vessel). One-leaved Cape Tulip.
[Drawing by C. A. Gardner.]

DESCRIPTION.

Homeria collina has a single, ribbed, grass-like leaf 12 inches or more long arising from a corm (the so-called bulb) which is surrounded by brown fibrous material. The stem is shorter than the leaf and produces a few flowers which are, at first, enveloped by green spathes. Each flower has six segments which are usually predominantly pink with a green or yellow base, but are sometimes entirely yellow. The flowers often exceed an inch in diameter. The narrow cylindrical seed vessel opens at the top to liberate numerous brown seeds. The name one-leaved Cape tulip is often applied to *H. collina*.

Homeria miniata has two or sometimes more grass-like leaves and in consequence is often referred to as two-leaved Cape tulip. These arise from a corm around which are formed numerous cormils (small "bulbs"), the whole being surrounded by dark fibrous material. The flowering stem gives rise to a number of flowers which emerge from green spathes. Each flower has six segments, pink in colour with the exception of the yellow base which is often blotched with green. The diameter of the flower seldom exceeds one inch. During the later stages of growth groups of cormils are formed in the angles formed by the leaves and the stem. Although *H. miniata* flowers freely, no plants bearing seeds have been noted in this State.

DISTRIBUTION.

Cape tulip now occupies several thousand acres of land in Western Australia and will monopolise many times this area unless active control measures are taken. It is known to occur from Mingenew to Manjimup and Albany and as far east as Kulin and Merredin.

The main centres of infestation are:—

1. Metropolitan area and environs including Osborne Park, Maylands, Cannington, Bayswater, Bassendean and Bullsbrook.
2. An area extending from Northam to York, Beverley and Mt. Kokeby.
3. Williams and Kojonup.

TOXIC PROPERTIES.

Cape tulip is not only significant as a weed but as a poisonous plant. Mackenzie (1910) found that the corm of *H. miniata* contains a glucoside, which has a digitalis-like action on the heart, raises the blood pressure, constricts blood vessels, and has an action similar to curare on voluntary muscle. He states that this glucoside is probably the active principle. Rindl (1924) isolated an alkaloid, homeridine, from the dried stems, leaves and flowers of *H. pallida* Baker and states that Dixon found that this alkaloid had pharmacological actions on the circulation similar to those of digitalis.

There is evidence to show that the poison occurs in all parts of the plants irrespective of whether they are fresh or dry.

Pappe (1857) describes a case of poisoning among natives due to eating the bulbs of *H. collina* and there are many references to losses of animals. Deaths are reported most frequently among cattle, although horses and sheep are also affected. A dose of 2lb. of green leaves caused fatal haemorrhagic gastro-enteritis in a calf in an experiment carried out by Hindmarsh in June, 1929, (Hurst 1942), while Steyn (1934) found that 220 gm. of the fresh bulbs and leaves in the flowering stage caused the death of a full grown sheep about thirty hours after administration. Similar properties can be assumed for *H. miniata.* Filmer (1926) fed two pounds of chopped leaves of this species to a cow which was found dead the next day.

Stock accustomed to grazing in areas infested with Cape tulip are seldom affected, probably because they avoid eating the plant. Even under these circumstances, however, deaths occur from time to time. The most serious mortalities have been experienced among animals brought from a district free of Cape tulip to one in which this weed is present in quantity. On many occasions deaths have occurred within a few hours.

Although, as mentioned previously, in a controlled experiment, Steyn in South Africa killed a sheep with approximately one half pound of the plant, there is no indubitable record of sheep having been poisoned in this State by Cape tulip.

Clarke (1939) describes the symptoms as partly those of an acute gastro-intestinal irritant and partly those of a cerebral depressant or narcotic. Examples of the first are abdominal pain, diarrhoea, and, if large amounts of green leafy material have been ingested, distension of the stomach with gas, the symptoms increasing in severity and resulting in colic, frequent scouring, great weakness and prostration. The nervous symptoms are indicated by dullness and depression.

Deaths may occur rapidly, within twelve hours or less after ingestion, or the animals may linger for several days.

Carne, Gardner and Bennetts (1926) describe lesions of intense gastro-enteritis and cardiac haemorrhages revealed by a post mortem examination of a bull poisoned by Cape tulip.

PROPAGATION.

Besides the production of a large number of seeds by the single leafed species, Cape tulip reproduces itself vegetatively, the details varying with the species. *H. collina* normally produces two corms of unequal size above the old withering corm, while *H. miniata* may give rise to several corms along with a considerable number of smaller structures known as cormils. Again, in *H. miniata* similar clusters of cormils are formed in the angles between the leaf base and the flowering stem.

There is no doubt that, particularly in the earlier days following its introduction, much of the spread of Cape tulip was due to its ornamental nature. Home gardeners, with every good intention, gave corms to friends, but this plant seldom remained confined to the garden boundaries and soon became abundant in localities suited to its growth. Even in recent years Cape tulip has been spread by this means.

Other agencies which have played their part in its dissemination include stock and vehicles, machinery, agricultural seeds, packing and nursery products such as balled fruit trees.

There is little risk of Cape tulip seeds occurring as impurities in graded agricultural seeds, but on several occasions both seeds and cormils have been found in subterranean clover burr and threshed, ungraded seed. Apart from any other consideration this provides ample reason for purchasing cleaned seed.

Straw packing represents a potential source of any weed and Cape tulip corms and cormils have been found in soil forming the balls around fruit trees being distributed from a nursery.

CONTROL.

Any control measures carried out against Cape tulip must be designed, not only to prevent seed formation but also to forestall the development of new corms and cormils. Observations carried out by the author in 1930 and subsequent years have shown that the development of new corms commences about the beginning of July, at which time the food reserves in the old corm are largely exhausted. Cashmore (1938) using pot-cultures found that the first evidence of new corm production occurred during August and early in September.

As, normally, full flowering does not occur until mid-September and seeds are not mature until a month or more later, the time of corm, rather than seed formation influences the initiation of control measures.

An effective chemical spray would provide a very convenient method but unfortunately, various chemicals have been tried in this and other States with little success. Experiments conducted by this Department proved a single application of sodium chlorate, atlacide and sulphuric acid to be ineffective, and Davies (1942) reported that the Council for Scientific and Industrial Research after six years of tests with various chemicals failed to secure satisfactory results with Cape tulip along with a number of other perennial weeds. Many chemicals, including dieselene, will kill the top growth but do not penetrate to the corm, and in order to obtain any appreciable reduction in the stand, it is necessary to spray several times each year, an undertaking only practicable for very limited areas. Unless the plants are growing in inaccessible places such as among rocks, grubbing must be considered a more satisfactory method.

The most effective means of control are grubbing and cultivation, the latter often being associated with a cropping programme. Where the areas are small or the plants scattered, grubbing is possible, but where appreciable areas are heavily effected, ploughing is more practical. Unless grubbing is carried out at the beginning of August or earlier there is every chance that new-season corms or cormils will have been formed and remain in the soil when the remainder of the plant is removed. When the flowering stage is reached the basal corm development is well advanced and grubbing at this stage often serves to distribute the weed rather than reduce infestation, unless extreme care is taken to remove the entire plant. If cormils are present, the surrounding soil as well should be removed and all placed in a bag or tin for disposal. All plants grubbed should be destroyed by burning.

The same principle must be applied to ploughing which should be carried out to the depth of the corms in July or early August. If the ploughing is done early in the season the old corm may still contain sufficient food reserves to initiate further growth while if delayed too long mature corms and cormils will have been produced. The vulnerable period is comparatively short and naturally varies somewhat with the season. The best method of ascertaining this period is to examine the plants and observe the relationship between the old and new corms. The importance of the time factor relative to cultural operations cannot

be overstressed and these should be carried out when the food reserves of the parent corm are almost exhausted and the new corms have not developed to the extent of being capable of independent growth. A further spring cultivation may be advisable depending on the regrowth of the tulip, but a summer working increases the cost of control measures without giving corresponding benefits.

In South Australia the single-leaved species has been controlled over an area of 500 acres by ploughing or cultivating at the critical period in three consecutive years. Similar results have been obtained on a smaller scale in this State.

In districts where stock are accustomed to the plant and seldom affected by it, good results have been secured, at the same time deriving some return from the land, by sowing an early maturing crop of oats, grazing heavily until the beginning of August and then ploughing. This practice is more suited to the Great Southern than the lower South-West. Sometimes it is possible to make a late sowing of a cereal following the ploughing in June or July and ground that is moist in the summer can be utilised for crops such as Japanese Millet and Sudan grass.

A difficulty is presented by the fact that some soils on which Cape tulip thrives are too wet to carry heavy machinery when the weed is at the vulnerable stage. Under these conditions it is often possible to use horse drawn implements for comparatively small areas. The alternative is to plough early and then, if possible, cultivate at the optimum time.

Although an appreciable reduction in the quantity of Cape tulip can be expected at the end of the first year's operations, active measures must be pursued for several years in order to cope with delayed germination of seeds and development of corms.

Repeated mowing to prevent flowering will arrest the spread of Cape tulip, although no experimental evidence is available to show whether the density of the infestation is reduced by the operation. Chipping with a hoe will also prevent seed formation but is essentially a measure of control rather than of eradication.

Thoroughness and persistence is required for the control of all perennial weeds and Cape tulip is no exception. A few plants allowed to seed will nullify much good work, and repeated inspections to detect further plants represent an important part of any programme directed against this weed. Spectacular results cannot be expected, and any scheme necessitates carrying out systematic measures for a number of years.

In compiling the information concerning control measures, I have been assisted greatly by discussions with Professor H. C. Trumble and Mr. A. J. K. Walker of the Waite Agriculture Research Institute, South Australia. As the result of a request from the Weeds Co-ordination Committees recently reconstituted in each State the Waite Institute has undertaken investigations into various aspects of Cape tulip control. This is an Australia-wide project and the Department of Agriculture is co-operating with Professor Trumble and Mr. Walker as far as Western Australian aspects are concerned.

LITERATURE CITED.

Carne, W. M., C. A. Gardner, and H. W. Bennetts (1926): "Plants poisonous to Stock in Western Australia," *Dept. Agric. W. Aust.*, Bull. 96, Revised Ed.

Cashmore, A. B. (1938) "Cape Tulip, *Homeria collina* Vent. var. *aurantiaca* Sweet. Life History Studies." *Journ. C.S.I.R.*, Vol. 11, No. 3, pp. 233-238.

Clarke, G H. (1939) "Cape Tulip. Important Weeds of South Australia." *Dept. Agric., S. Aust.* Bull. No. 343, pp. 30-42.

Davies, J. G. (1942): "Pasture Research by the Division of Plant Industry," *Journ. C.S.I.R.* Vol. 15, No. 3, pp. 248-252.

Filmer, J. F. (1926) "Cape Tulip (*Homeria miniata*) A Poison Plant." *Journ. Dept. Agric., W. Aust.*, Vol. 3, pp. 240-243.

Hurst, E. (1942): "The Poison Plants of New South Wales." The New South Wales Poison Plants Committee, p. 70.

MacKenzie, A. T. (1910): "A Brief Account of the Pharmacological (or Physiological) Action of a Western Province Tulip." *Homeria collina* Vent. var. *miniata. S. African Med. Record,* Vol. 8. p. 94.

Pappe, L. (1857): "Florae Capensis Medicae Prodromus," 2nd Edition, W. Britain, St. George's Street, Capetown.

Rindl, M. (1924): "Preliminary Note on a Poisonous Alkaloid from the Overground Portions of the Transvaal Yellow Tulp (*Homeria pallida*) *Trans. Roy. Soc., S. Africa.*, Vol. 11, p. 251.

Steyn, D. G. (1934): "The Toxicology of Plants in South Africa." Central News-agency, Ltd., South Africa, p. 551.

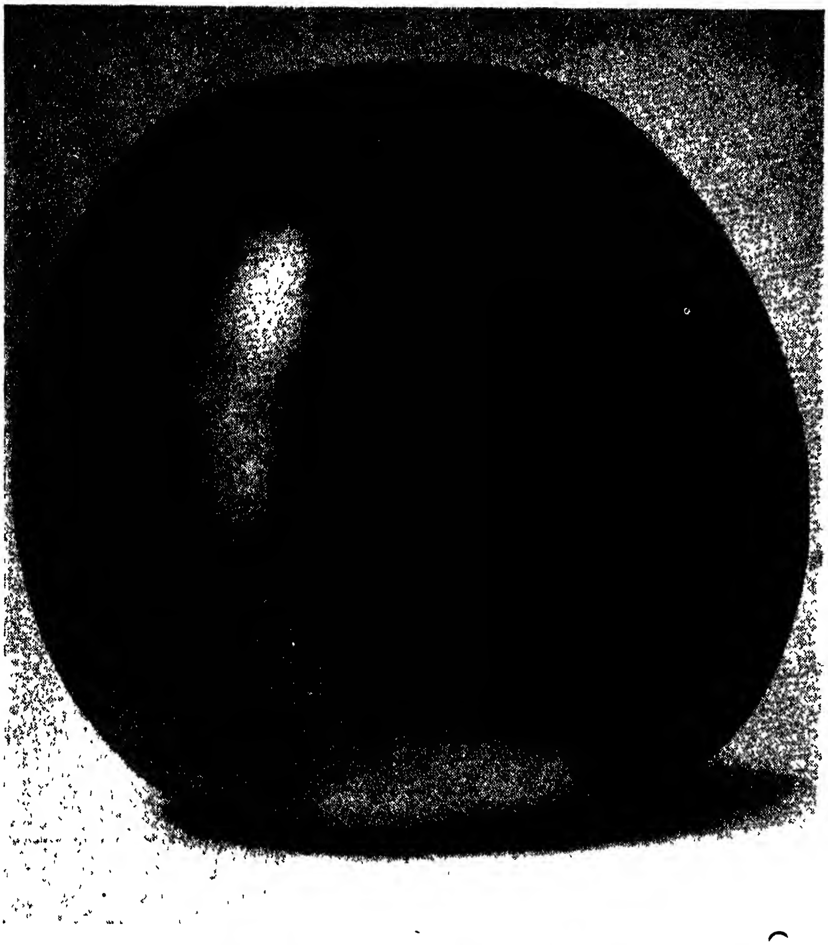
THE FRUIT INDUSTRY IN W.A.

H. R. POWELL, Superintendent of Horticulture.

THE fruit industry (as most people know) is a very extensive one, our congenial climate permits the growing of a great range of fruits. Apples and pears grow in the hills districts and lower Great Southern and South-Western districts. Such towns as Mt. Barker, Donnybrook and Bridgetown are perhaps as well known as the apples, which are grown in the well-kept orchards surrounding them. Western Australia is one of the leading apple producing States of the Commonwealth—one State only, namely, Tasmania, produces more. Last season the apple crop approached 2,500,000 bushels—a record crop certainly, but on the other hand crops of this magnitude can be expected to occur again every few years. There are approximately 11,200 acres planted to apple trees in the favoured districts which are many miles apart.

A favoured district must possess congenial soil and climatic conditions to produce good quality fruit. Sometimes continued dry weather during the growing season causes havoc by restricting normal development. Apple trees become stressed for want of soil moisture and thus the fruit cannot come up to proper size. Hot and dry weather, too, during critical months of growth, can cause enormous damage to susceptible varieties by inducing pre-harvest drop. Early last March, at the commencement of the harvesting season, one-third of the total crop

of Jonathans fell to the ground during one week-end. Fortunately, there are certain growth hormones that can be used to prevent pre-harvest drop. Commercial supplies are available here and full details are available as to how to use them. The spray should be applied to the trees several weeks before the time the critical weather conditions are expected. In the Eastern States the hormone spray is very effective in preventing the premature fall of Bartlett pears.



Granny Smith 2⅝in. apple seen at Singapore affected with "scald" in association with sun-burn injury.

Photo: H. R. Powell.

In addition to the losses caused by fruit drop, damage can be caused to the fruit by direct sunburning. During severe hot weather some fruit can be actually cooked on the trees. This obviously defective fruit is never packed but many apples, slightly sunburnt, are often packed by growers. For immediate local market consumption no great harm is done—the fruit is quite edible and the only defect is a yellowish discolouration of the skin. It is another story when it comes to late-stored Granny Smiths. After the fruit has been in store for several months the sunburned areas become very susceptible to "scald." This is best described as a dark brownish discolouration of the skin, which does not affect the tissues underneath.

In certain years "scald" is prevalent, and it is always worst on early fruit picked at the stage of greenness desired by overseas buyers in the United Kingdom and Singapore. It was surprising to notice in Singapore that "scald," particularly associated with sunburning, even slight sunburning, developed into a colour almost as black as ebony. This development is perhaps due to the different climatic conditions, but there is no doubt that this disorder can become a major defect with late stored Granny Smiths. Some little time ago one Singapore shipment turned out badly as far as "scald" was concerned. This made buyers nervous, and a subsequent shipment brought comparatively poor prices due to a fear that this disorder would be prevalent again.

The climate again can affect fruit quality—this time rain, when Granny Smiths are being picked and packed—can make the fruit very susceptible to bruising.

In Singapore, too, bruising is regarding as a major defect and recently large sizes, 2¾ and 2½, were seen that were particularly badly affected. When things become normal again trade will not be so easy with this country and other overseas markets as it is now. Fruit will come in freely from other sources. The American season does not commence until July-August with fresh apples, Gravensteins, but it is possible for American exporters to secure most of the apple trade in Singapore after that date as they did with "Sunkist" oranges before the last war.

South Africa, too, is becoming a serious competitor with oranges and it was learnt recently that apples will be sent to Singapore this season. During the prewar years South African apples were exported in large quanties to the United Kingdom and there they secured a very good reputation for quality. With rigid control of export fruit, including varieties, quality standards and cold storage, the ships that carry fruit, and a thorough knowledge of the overseas fruit market requirements, the South Africans are capable of seriously competing with Australian fruit on all the world's markets.

There is no reason to be pessimistic at the present time, but equally so it would be foolish to be optimistic, unless cognisance is taken of the danger signals and steps are taken to meet the competition.

To sum up, the two major faults appear to be "scald" and bruising, and there is no doubt that these defects can prejudice present market prospects.

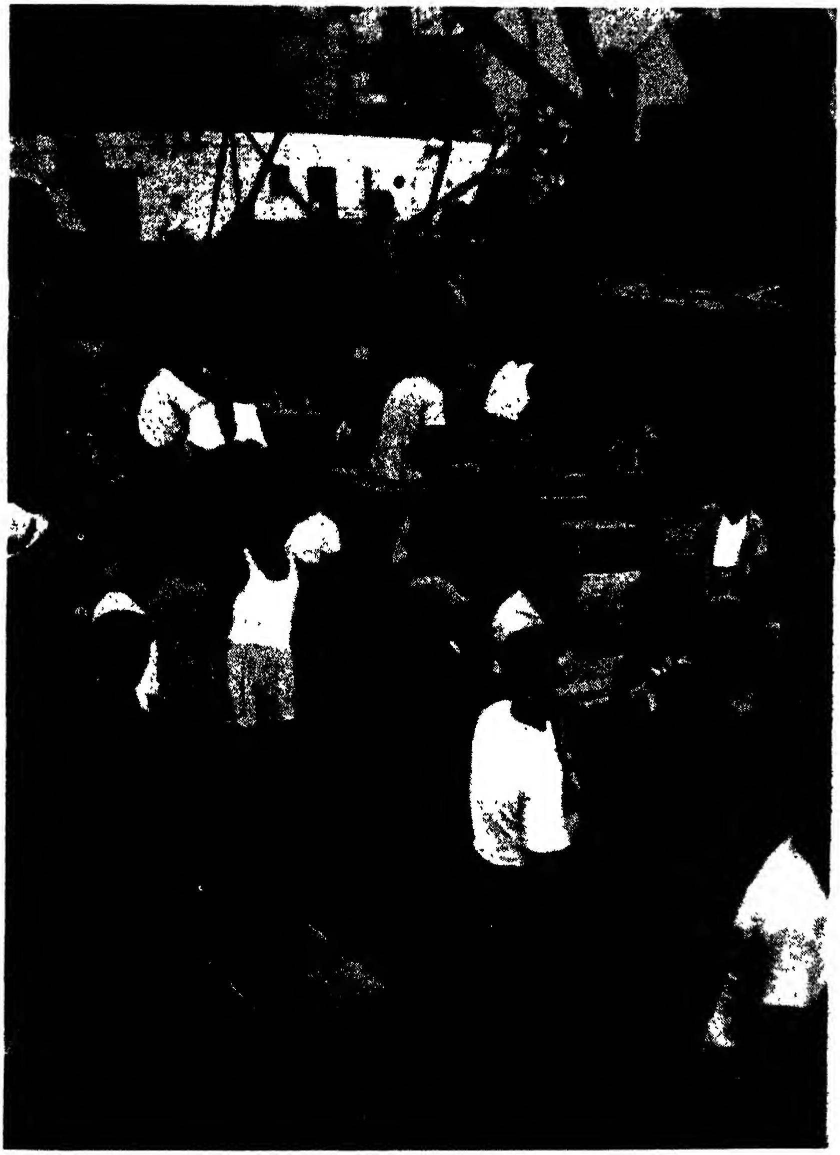
Now for a few words about oranges. The orange districts are so well known that I will not dwell upon them except to say that they extend from Mooliabeenie in the north to Capel and Donnybrook in the south. Production is not large and usually ranges from 300,000 to 350,000 bushels. This quantity, however, is too large to be marketed profitably locally and some export outlets are necessary.

During recent years shipments have been made to Singapore. Unlike apples, however, which meet no competition from fruit produced in nearby countries, oranges from all sources meet very strong competition with mandarins from Siam and China. These mandarins are very sweet and juicy and are very popular with the Chinese. The season for the Chinese mandarin commences at the end of November and extends to March, and the greatest quantities are marketed during January and February. The Siamese mandarin season extends from October to December. During the time under review wholesale prices for Australian oranges were depressed owing to heavy supplies of these mandarins on the market.

Oranges from a number of sources—New South Wales, South Australia, Victoria, our own and cool-stored fruit from South Africa were compared. As far as some Western Australian fruit was concerned the major defects seen

were a yellow colour and a lack of sweetness. The Chinese prefer very sweet fruit with a bright orange colour. It is difficult to see how these faults can be overcome. Ways and means of improving our pack will, however, be discussed with growers and shippers with the hope that a large part of the present trade can be retained.

It must be remembered that the Californian "Sunkist" fruit enjoyed a premium on this market before the war and the trade will be resumed when present financial difficulties are overcome.—(*Extracted from a broadcast by permission of 6WF-6WN.*)



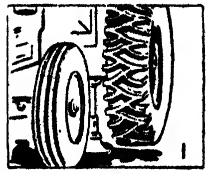
Granny Smith apples are popular in Singapore. Photograph shows importers waiting for their fruit to be unloaded from M.V. Orestes last November.
Photo: H. R. Powell.

Water Inflation of Tractor Tyres.

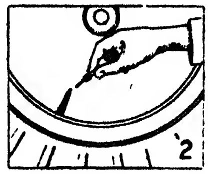
To Water Inflate Your Tyres.

Directions:

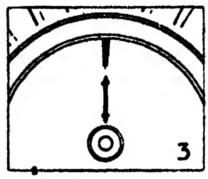
1. Jack the tyre to be water-inflated clear of the ground.



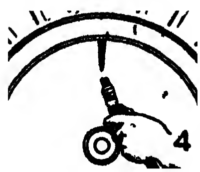
2. Remove core from valve stem. In the case of Special Water Inflation Valve, unscrew and remove valve stems and allow air to completely expel itself from the tyre.



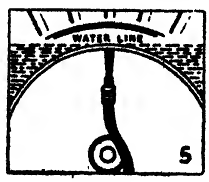
3. Revolve tractor wheel until tube valve is in a 12 o'clock position, that is, directly above the wheel hub.



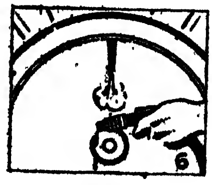
4. Connect water hose to tyre valve with water valve coupling.



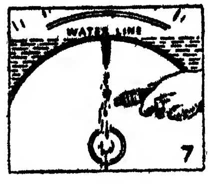
5. Fill the tyre with water up to the valve level while it is in a 12 o'clock position.



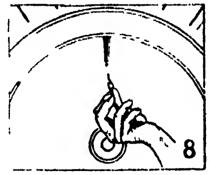
6. Remove water valve coupling from tyre tube valve from time to time to "bleed" the remaining air in the tube, otherwise this remaining air will act as back pressure and prevent the water from entering the tyre.



7. To ensure that you have the correct amount of water-inflation, continue to fill the tyre with water with valve still in the 12 o'clock position, until water flows out of the valve. Allow the surplus water to drain off still keeping the valve in the 12 o'clock position.

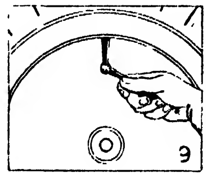


8. When surplus water has ceased to flow from the valve replace the valve core or insertion piece.

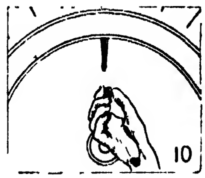


9. Now inflate the part water-inflated tyre with air to the correct pressure.

Minimum: Front Tyres .. 28 lbs.
Minimum: Rear Tyres .. 12 lbs.



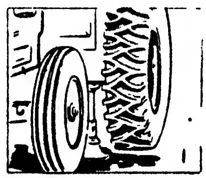
10. Replace valve dust cover firmly and remove jack.



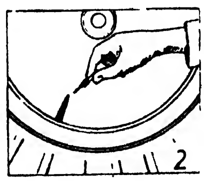
To Remove Water from Tyres.

Directions:

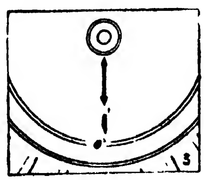
1. Jack the tyre to be drained of water clear of the ground.



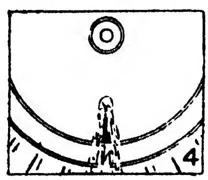
2. Remove core from valve stem. (With special Water Inflation Valve, unscrew and remove insertion piece.)



3. Revolve tractor wheel until tube valve is in a 6 o'clock position, that is, directly below the wheel hub.



4. With valve in the 6 o'clock position, allow water to drain.



Information by courtesy "Dunlop Operation Manual."

THE BRACKEN FERN AND ITS ERADICATION.

M. CULLITY,
Superintendent of Dairying.

Bracken fern is widely distributed over the earth and is probably one of the oldest of plants, dating from cretaceous times. During the long period of its existence it has proved resistant to fungoid and insect attack. Actually in surviving the varying conditions of the changing times. it has proved its adaptability and extreme resistance to haphazard methods of control.

It is a common pest in the south-western portion of this State and throughout many other parts of Australia. In fact it is so common that it is accepted as a permanent resident and frequently no effort is made to control it. It covers hundreds of acres of once cleared land which otherwise could carry useful pastures.

In Western Australia it is gradually occupying increased areas. Its incidence is greatest on those properties with the largest cleared areas and therefore it is easy to understand why more is not heard of the loss of country. In general it may be said that sufficient is known of the methods of control in this State to prevent it from becoming a serious pest on small well-worked properties.

A picture of this plant and its method of vegetative growth and aggression is best given in the words of K. W. Braid[1]:—

"The bracken plant consists of a bulky underground system which extends for many dozens of square yards. Many a patch of bracken is in fact one extensive plant annually producing hundreds of fronds. Possibly even large bracken areas are all one plant, so it is obvious that the whole must be attacked as a unit. Under ideal conditions of good deep soil the subterranean system can be shown to be made up of three or more tiers of rhizomes or underground stems. The lowest tier —the leader—usually runs at a depth of 15 to 25 inches and is the main invading system. It possesses the thickest rhizomes ending in a terminal finger-like bud which periodically produces side buds to right and to left. This is figured in the diagram as A. (fig. 1). The side buds develop into branches which bend upwards and move horizontally in a region above, and if they are within nine inches or less of the surface often bear fronds (B). They also produce subsidiary buds which grow into much thinner, shorter branches, often characteristically zigzagged (C and C1). These approach nearer to the surface and frequently produce fronds in groups. The proportions in which these tiers are produced depend on soil depth and texture and the food ingredients available. Given good friable soil of good feeding quality, tiers A and B are abundantly produced, while if conditions are such as to check these, C develops most. Near the periphery of an area A and B are most abundant and tier C commonest about the centre. If for any reasons the depth of soil decreases, as for example when the subsoil of a rock approaches within seven to nine inches of the surface, all these zones get compressed into one layer overlying the subsoil, but the downward tendency of the terminal bud on A is such that if it reaches deeper soil three or even four tiers will again be exhibited. In all cases the terminal bud of each tier is the most active growing bud. By the division of the terminal cell it gives rise to lateral buds producing either branches or fronds. These may produce buds which may lie dormant for some years. Normally the fronds of each season arise from the side buds immediately behind the terminal buds of tiers B and C, but sometimes subsidiary buds may also develop at the base of these.

"If the frond is destroyed in the green state, the bud destined for next season's frond begins to develop and in addition some of the dormant buds or subsidiary buds develop into fronds."

The fact that the rhizomes are in tiers at varying depths explains how the plant survives the heat of summer. Water in large quantities is needed to replace that lost by transpiration and this can always be obtained by the deepest rhizomes, and with this water it also obtains much mineral food.

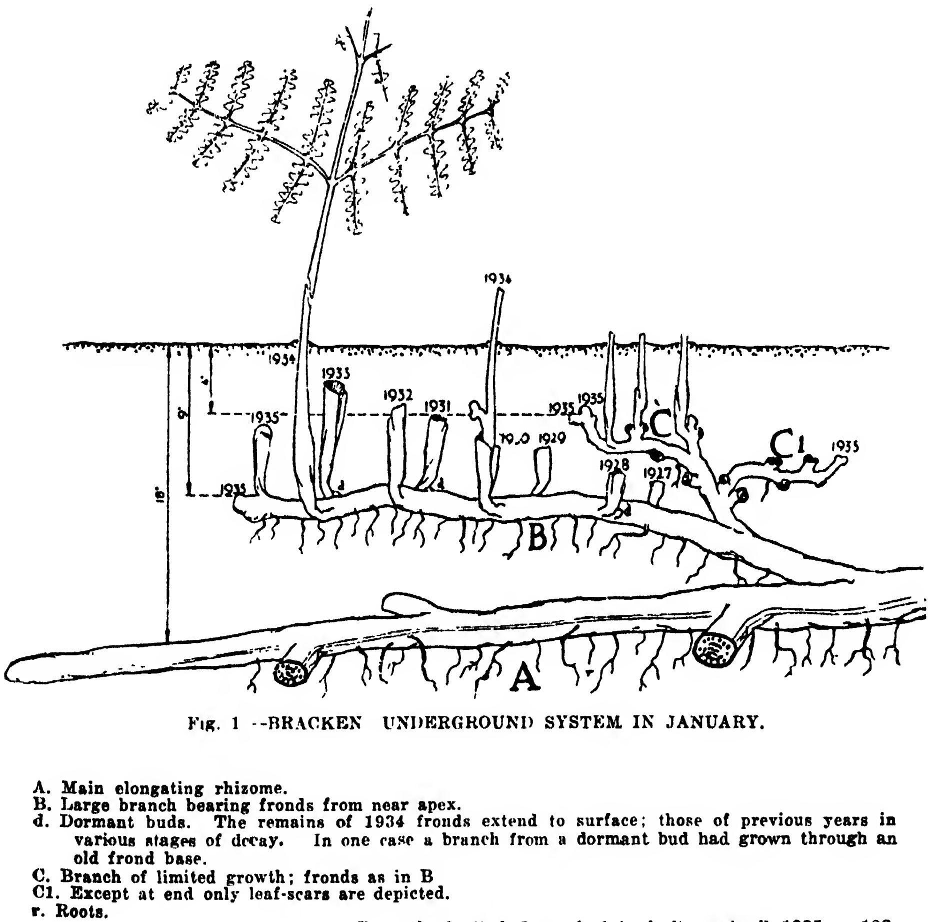


FIG. 1 --BRACKEN UNDERGROUND SYSTEM IN JANUARY.

A. Main elongating rhizome.
B. Large branch bearing fronds from near apex.
d. Dormant buds. The remains of 1934 fronds extend to surface; those of previous years in various stages of decay. In one case a branch from a dormant bud had grown through an old frond base.
C. Branch of limited growth; fronds as in B
C1. Except at end only leaf-scars are depicted.
r. Roots.

From the Scottish Journal of Agriculture, April, 1935, p. 122.

"The bulk of the rhizome may be enormous, five or even ten or more feet of it lying below each square foot of surface. This is packed with food reserves such as sugars and starch. All these food reserves are manufactured in the fronds from the carbon dioxide in the atmosphere and the water and minerals absorbed from the soil.

"The removal of the fronds therefore (a) prevents the building up of further foodstuffs, (b) exhausts the underground reserves by inducing attempts to produce new leaves. Theoretically (and this is backed by experiment), the best time to destroy the fronds is when they have reached their maximum growth, *i.e.*, when they have drained the rhizome but have not begun to contribute food."

This statement agrees with the conclusion reached from observations in this State, that the optimum time for cutting is at the end of spring when the fronds have made full growth. There is always a smaller crop of young fronds after cutting at this time than after cutting at any other period of the year. Where two cuttings per year are carried out, one in October-November when the fronds are at full growth and another in May-June the depressing effect on the plants is greatest. Cuttings in January, February or March appear to have little effect in reducing the thickness of the succeeding crop. Cutting from May to September results in a fairly large crop of young fronds, but when this is followed by another when the plant is at full growth a greater effect is obtained. It is better to cut early say in August than to delay till February.

That the removal of the fronds will cause a depletion of the rhizomes is confirmed by examinations carried out by Smith[2]:—

"When the rhizomes from the trial holes were examined depletion of the larger storage rhizomes was evident. Those from an uncut area were large and plump and hard for large distances and only old parts showed decay. Rhizomes from the cut plots were shrunk from a short distance behind the growing point, and they contained a milky fluid instead of the firm white tissue of normal bracken."

Hendrick[3] showed by a series of analyses that the amount of food reserves as expressed by soluble carbohydrates and nitrogen diminishes steadily up till the time of maximum growth of the fronds after which there is again an increase.

The starvation of the root system is also demonstrated by the diminishing size of the fronds.

There can be no doubt that the cutting of bracken is the most effective method of attack, but unfortunately this method cannot always be economically applied.

An outline of procedure which it is suggested should be followed is given hereunder. For convenience it is proposed to consider an area of partially cleared country and to follow its progress from a bracken infested area until it is an area of open pasture. A consideration of bracken in virgin country will not be made as in these conditions it cannot be described as a serious pest, and the method of attack necessary to subdue it would be an expensive one. Usually, however, the bracken does not assume the proportions of a pest until some preliminary clearing is carried out allowing more sunlight to reach the areas where the outpost plants are existing.

If it is impossible to commence clearing the area more thoroughly and it is necessary to attempt a reduction in the amount of the pest, the following methods may be applied.

Fire.—In areas such as those under consideration it is possible almost every year to get a fire to go through the paddock burning the dead bracken and at least killing the green fronds. It is more usual to burn every second or third year when a more intense fire and a cleaner result can be obtained. Experience has shown, however, that this method of control is totally ineffective as a means of eradication of bracken unless it is combined with certain other steps. It can only be considered as a method justified by expediency, inasmuch as the pest is not actually checked but the ground is cleared of the dry debris. As a consequence young grass is allowed slightly more space in which to grow, and stock will be able to make their way more easily through the areas so treated. This method is of course usually restricted to large paddocks.

Pasture.—Good results have been obtained by sowing subterranean clover seed on the ashes after a burn as described above, and topdressing with superphosphate. The clover usually is able to make rapid development until such time as the bracken growth and debris again is smothering the area and another fire is needed. This growth of clover entices stock into the area which then assist in counteracting the pest by their eating or trampling the young fronds. Kikuyu-grass is also of value in controlling small areas. Dibbled in about 2 ft. apart each way plants will spread rapidly and cover the ground in one year providing they are protected from stock for this period. The mat of grass will subdue the fern.

Cutting.—A further step which is occasionally taken in conjunction with the above is the use of the fern hook to clear the area periodically. This entails either the gathering of the fern into heaps for burning or recourse to a running fire, to clear the ground. The employment of the fern hook will depend for its efficiency on the time of the year that it is used.

Subdivision.—While the methods referred to above will gradually open up the paddock, the erection of subdivisional fences will assist in speeding up the attack. The trampling effect of the stock by being localised will be more severe, and it will be easier to carry into operation a plan for more offensive methods.

Clearing.—The clearing of the stumps and fallen trees must be carried out before it can be hoped to fully subdue the fern. The ground is then ready for the plough, and it is usual to sow a crop of some sort in order to level the ground sufficiently for the use of the mower. As a means of subduing the fern the plough is not as effective when used before a period of cutting as it is when used after. The deepest rhizomes are untouched and remain vigorous to take up the attack. After a series of cutting the higher rhizomes are weakened and the lowest which usually do not produce fronds commence to grow towards the surface so that the production of fronds may be continued. It can be easily realised therefore that a ploughing after a period of cutting will be much more effective in breaking up the whole of the rhizome system.

Mowing.—The ground after having been ploughed and cultivated will be in a level condition and fit for the use of a mower. The system of attack by cutting can then be carried out with this implement. Unfortunately the optimum time for doing this work coincides with one of the busiest periods on a farm, the harvest. That cutting at this period is effective is proved by the fact that the bracken does not survive if a paddock is cut two or three times for hay.

Old Pasture.—Where it is desired to reclaim old pasture which has been allowed to succumb to the advance of bracken, the method to be adopted will vary according to the density of the growth. Assuming the field to be densely covered it is suggested the best results would be obtained by following the steps suggested hereunder or variations thereof:—

(a) clear the paddock of the accumulation of dead bracken by burning during the late summer.

(b) If subterranean clover is not present sow on the ashes up to six pounds of inoculated clean seed or an equivalent amount of burr per acre, the rate depending on the original density of the bracken. Six pounds per acre will give a complete cover in the first season.

(c) Fertilise with one bag of superphosphate per acre.

(d) Stock lightly, allowing the clover to seed.
(e) Mow the paddock in November even if the hay crop be unsuccessful.
(f) In the following autumn mow the regrowth of bracken, fertilise with superphosphate and allow stock to graze more heavily.
(g) Close the paddock early and cut for hay.

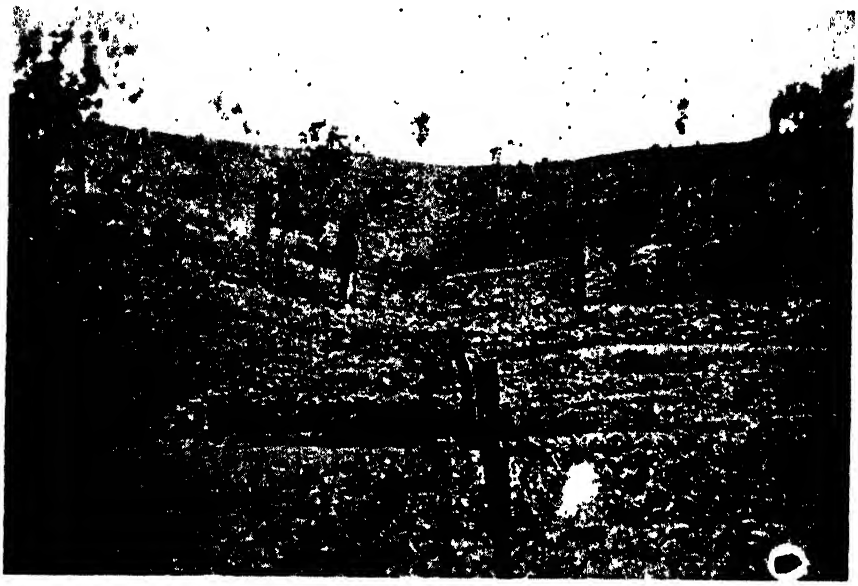


Fig. 2.—Partially cleared country, rendered temporarily useless by a heavy growth of bracken.
Photo—M. Cullity.

Fig. 3.—A fully cleared hillside, completely covered with bracken. Clearing fires have not checked its growth.
Photo—M. Cullity.

The process of cutting twice annually should be continued for two seasons, when the densest bracken will have been severely checked. If preferred after two seasons' cutting, a crop could be sown and the ploughing necessary would be effective in cutting to pieces the weakened rhizomes, which would have drawn closer to the surface.

Other Methods of Attack.

Whipping has been carried out in certain countries, particularly France. There does not appear to be any very definite information available as to its efficiency. There can be no doubt that the bruising effect particularly during the growing period would weaken the root system. As far as can be ascertained the comparative effects of cutting at the optimum time and whipping have never been studied.

Fig. 4.—Subterranean clover growing vigorously amongst bracken.. The trampling of the stock has effected a great reduction in the density of the plants.
Photo—M. Cullity.

Rolling.

Much has been claimed for various types of rollers and drags. The latter have been of various types, heavy rails fixed at right angles to the line of draught or fitted together to make a triangle have been used with success. However where these can be used the mower will do a better job.

Rollers have also been of numerous designs, some single round logs, others fitted with blades which have the effect of cutting or crinkling the stalks.

Most types require clean open paddocks, fairly free of stumps and fallen trees, conditions which would be suitable in many cases for an old mower.

A very effective roller has been designed by Messrs. W. J. & S. Rooney of Glen Warren, Manjimup, and which has the advantage of being able to cover large areas relatively quickly. Being tractor drawn more than one roller can be used. A simple method of yolking them was devised and is illustrated in Fig. 5.

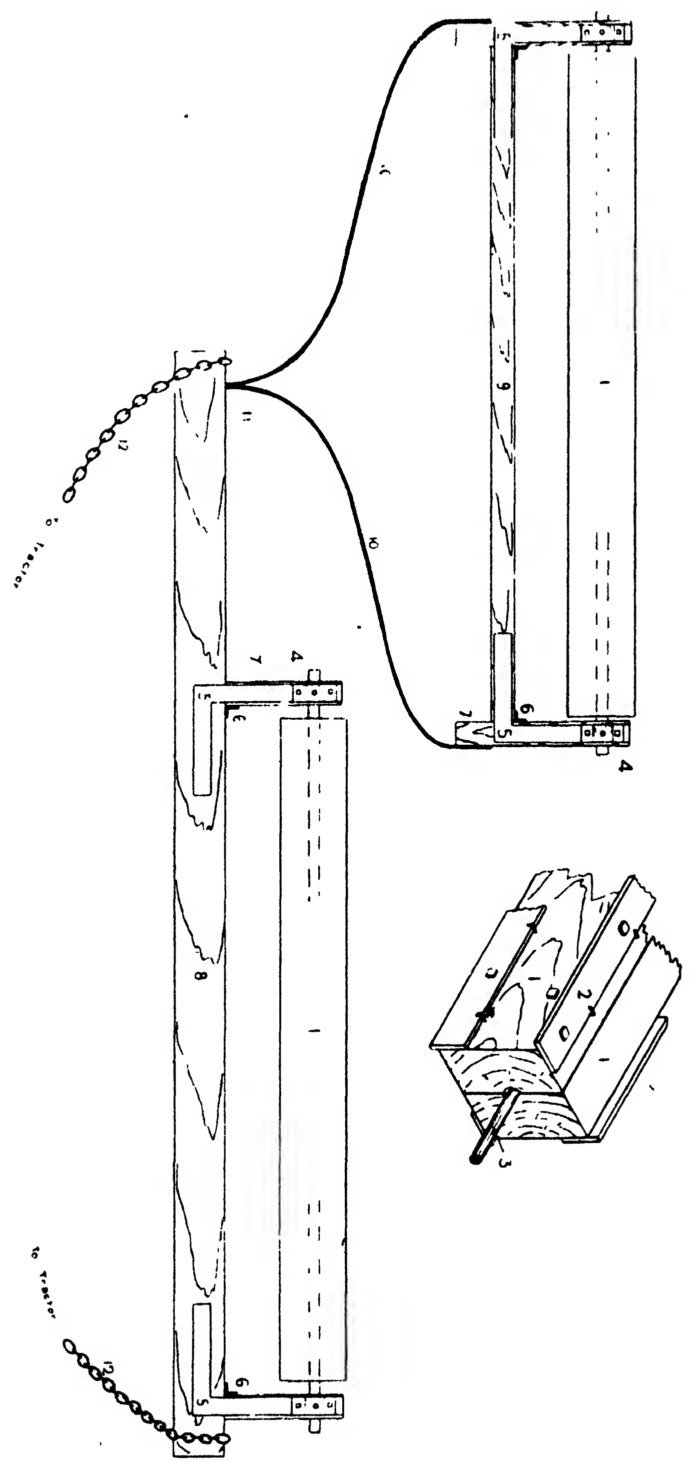


Fig. 5.—DIAGRAM OF ROLLER.

1. Two 9ft. timber sleepers bolted together with four ⅝in. x 12in. bolts.
2. Steel blades. Grader blades where possible bolted through sleepers and fastened by dog spikes. Blades to project from 1in. to 1½in.
3. Axle 1¾in. Can be made from spring cart axle cut in halves.
4. Bearing with grease nipple.
5. Flat angle irons about 3in. x ½in. extending to back of timber frame.
6. 2in. x ⅛in. angles.
7. and 9. 4in. x 2in. timber frames.
8. 8in. x 2in. timber (karri).
10. Iron frame for roller swivelled at roller end
11. Connection to beam must be attached in such manner as to allow free movement.
12. Chain connection to tractor.

(Drawing by Department of Lands and Surveys from information by S. Rooney.)

The rollers are square in section being constructed from sleepers bolted together and protected on the cutting edge by steel plates.

Photographs of the tractor and rollers in operation are shown in Figs. 6 and 7. The general method of hitching the rollers to the tractor may be seen while a good impression of the density of bracken is also given.

Fig. 6.—Tractor and rollers Rolled fern in background
Photo—C Rooney.

Mr. W. J. Rooney wrote regarding his experiences—"I am at present busy rolling all the fern paddocks and although they are greatly improved from last season there has been a strong crop of new ferns. Last year I was able only to get through with the tractor by having a man walking ahead and showing me stumps and holes. This time I can see most of them from the tractor.

"Other country rolled last year has responded very well. There has been a particularly good germination of clovers in this district and, although fresh ferns are coming again, they are stunted and scattered compared to what they were.

"I have been putting two rollers behind a 'Farmall H' and with an approximate 15ft. sweep it does not take long to cover a large area. Two horses can pull one roller without difficulty.

Fig. 7.—Tractor and rollers. Approaching high fern.
Photo—C. Rooney.

"In high thick fern the results are spectacular—hardly a fern remains unbroken in two or more places. Where the ferns are small and scattered the percentage knocked down and bruised is smaller. This might be overcome by fitting extra blades and making the roller six or even eight-sided. The four sides and cutting edges, however, are an advantage in rough uneven country as the drag is greater and the blades bite in to some extent. I am under the impression that it would be an advantage to have blades drawn out to a cutting edge, not to cut the fern but to bite deeper and equalise the affect of uneven ground.

"A proper hitch as illustrated is necessary, as otherwise in hilly country, one roller had a tendency to gain and override the other.

"We have tried the fernhook, mower, railway iron, fire and so on but, so far, this looks the most practical method. The mower used often enough does good work, but is limited to clear country. I have had the rollers over boulders, stumps and logs and have even bashed an occasional tree without damaging them."

Pigs.—The use of pigs that have not been nose rung is quite successful. The animals like the succulent roots and will turn over much ground in order to reach them. It is obvious however that their use on a large scale for this purpose is not practicable.

Weedicides.—Much promise was attached to the possibility of attack with weedicides. As the clearing of bracken is undertaken primarily to allow utilisation of the ground for other plants, the selection of a weedicide is limited to those which, while destroying the plants will not injure the soil. Among the substances capable of performing the work the chlorates of sodium and calcium are the most useful. It has been demonstrated by Braid and others that it is possible to get a complete kill, of both fronds and roots by a single application of sodium chlorate. For this purpose a dressing of not less than two hundredweights per acre is required. As the chemical is high in price this method is, temporarily at least, prohibitive. Another system is the application of sodium chlorate direct to the cut stalk of the frond by the use of a piece of sponge rubber saturated with a solution of the chemical, attached to the blade of a scythe or to the cutter bar of a mower. This system is claimed to be fully effective and uses only a small amount of the chlorate.

Fig. 8.—Bracken being beaten back from pasture. In the foreground the clear space has been mown for hay during the past two seasons The headland along the fence is still carrying vigorous plants. In the background the fern has been cut by the mower.
Photo—M. Cullity.

However there is no record of the method having been used in Western Australia. Interest has also been shown in the use of one of the hormones as a selective weedicide, but no information regarding its effectiveness is as yet available.

References:—
[1] K. W. Braid—"Scottish Journal of Agriculture," Vol. XVIII., No. 2.
[2] W. G. Smith—Trans. Bot. Soc., Edinburgh.
[3] J. Hendrick—Kew Bulletin, No. 4, 1921.

RESPONSES OF WHEAT TO COPPER AND ZINC AT DONGARA.

By T. C. DUNNE, Plant Nutrition Officer, and
G. L. THROSSELL, Agricultural Adviser.

IN 1942, Teakle reported increased yields from the use of copper and zinc applied together in a trial supervised by Davenport at Dongara. In this instance, the use of these elements increased the yields of wheat from 12.2 bushels (with superphosphate) to 14.6 bushels. The increase was statistically significant. Equal improvement in yield was obtained from the use of ground roaster residues which contain both zinc and copper, used at the rate of 200 lb. per acre.

No further data were obtained until 1947 when it was possible to accept the offer of a Dongara farmer to assist in conducting the further experiment which is reported hereunder.

EXPERIMENTAL SITE.

The site of the experiment was on a fine loamy sand, dark grey-brown in colour and very high in lime (41-58%). The pH value of both the surface (0-6") and subsurface layers (6-12") was 8.5. The area, which was originally covered with a heavy growth of wattle (*Acacia spp.*) and various climbers, was cleared in 1940. Since that time, three cereal crops had been grown. Neither copper nor zinc had been previously used on the site chosen, although copper fertilisers had been used on other parts of the property.

CULTIVATION AND SEEDING.

Following weed germination by April rains, ploughing to a depth of three to four inches was done in May, 1947. No further pre-seeding cultivation was necessary and seeding was done on June 8th and 9th with a combined cultivator drill.

Ranee wheat was sown at the rate of 60 lb. per acre.

FERTILISER TREATMENTS.

The layout used consisted of five blocks each containing seven randomised treatments giving thirty-five plots in all. Each plot covered .1 acre, being one drill-width wide (sown wheel on wheel) and 625 links long.

It was decided to use zinc (Zn) and copper (Cu) with superphosphate, both singly and together. A further treatment included the use, in addition, of manganese (Mn), magnesium (Mg), borax (B) and molybdenum (Mo). Another variation, because of the high lime content of the soil, was the addition of potassium (K) to this superphosphate-"minor" element mixture. Finally, because of the relatively high phosphorous (P) status of the soil as compared with most soil types in the State, one treatment consisted of all mineral elements tested but without superphosphate.

The fertiliser mixtures used therefore were as follows:—

Treatment.	Fertiliser.
A	Control—superphosphate 112 lb./acre.
B	Treatment A plus copper sulphate 10 lb./acre.
C	Treatment A plus zinc sulphate 5 lb./acre.
D	Treatment A plus copper sulphate 10 lb./acre. plus zinc sulphate 5 lb./acre.
E	Treatment D plus magnesium sulphate 20 lb./acre. plus manganese sulphate 10 lb./acre. plus borax 5 lb./acre plus roasted molybdenite 4 oz./acre.
F	Treatment E plus sulphate of potash (30%) 56 lb./acre.
G	Treatment F minus superphosphate.

SEASONAL GROWTH.

Seasonal conditions were good. Weed growth had been controlled by the initial ploughing and planting was done under excellent conditions. With the exception of a relatively dry August the rainfall was very good until the end of October. Following are 1947 rainfall figures in points for Dongara:—

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total May-Oct.	Total Jan.-Dec.
2	0	1	132	373	396	416	112	189	413	48	4	1899	2038

In the early growth stages, the plots receiving the more complete minor element mixtures, i.e. treatments E, F and G, were retarded. This effect was overcome by August and it will be seen later that one of these viz., treatment F, finally gave the highest yield though not significantly greater than treatment D.

Plots which did not receive zinc (treatments A and B) showed progressively poorer growth than the others. Withering of leaves, which gradually became more pronounced developed in July. Leaves of plants showed a yellow to light green striping a little inward from the edges. In mid-September, when the plants were heading out, those without zinc were 6-12in. shorter than other plants. Maturity was delayed about two weeks.

Copper did not appear to improve growth. At the September inspection there was no definite growth difference between the plants of treatments A and B or between the plants of treatments C and D although eventually there was a substantial difference in yield between C and D treatments. However, as maturity approached the plants without copper showed weakness in the straw about six inches below the ear. This caused the ears to bend over and in some cases to hang parallel with the stem.

By mid-September, the addition of potash in treatment F had given increased growth as compared with plants which had received the mixture of all other elements (treatment E). However, the plants of treatment G which received potash and all other elements except superphosphate, were not as well grown. At this stage, therefore, superphosphate had also given benefit.

YIELDS.

Yields generally were satisfactory and in some instances surprising. In this connection it was demonstrated once again that any effect of copper cannot be judged by vegetative growth but that grain yields are necessary if any benefit is to be determined.

The following results were obtained—

Treatment	bush.	lb.	% of control.
A—Superphosphate	17	16	100
B—Superphosphate, plus Cu ..	20	42	120
C—Superphosphate, plus Zn ..	20	42	120
D—Superphosphate, plus Cu, Zn ..	31	4	180
E—Superphosphate, plus Cu, Zn, Mn, Mg, B, Mo	28	30	165
F—Superphosphate, plus Cu, Zn, Mn, Mg, B, Mo, K	31	56	185
G—No superphosphate, Cu, Zn, Mn, Mg, B, Mo, K	26	36	154

Difference for significance at 5% level = 1 bush. 22 lb.
Difference for significance at 1% level = 1 bush. 51 lb.

DISCUSSION OF RESULTS.

It will be seen that while copper and zinc when used with superphosphate each gave statistically significant increased yields (increase 3 bush. 26 lb./ac.) over the control, a much more striking increase (13 bush. 48 lb.) was obtained when both were used in combination. Observations suggest that the beneficial effect of zinc was due to increased vegetative growth whereas copper is needed to ensure the formation of grain. Their use together therefore gave a vastly improved yield.

It should be noted that the zinc content (approximate total 250 ppm. water soluble 160 ppm.) of the superphosphate made from African rock and used in this experiment was considerably below that of the prewar superphosphate (approximate zinc content—total 500 ppm., water soluble 450 ppm.) made from Nauru Island rock. However, it must be remembered that the response reported by Teakle was obtained in an experiment conducted in 1941 when Nauru Island was the source of phosphatic material. Benefit was therefore obtained from the use of zinc on this soil type irrespective of the zinc content of the phosphatic rock used for the manufacture of superphosphate.

It is difficult to determine the effect of potash on crop yield, because of the initial retardation of growth, attributed to other mineral elements, of the plots to which this fertiliser was applied. The lowest figure for potash content of top

leaves in September (superphosphate, copper, zinc plot—potassium 1.65%) indicated a reasonable supply of this element but a definite conclusion must await further field trials.

As the comparisons for determining the value of superphosphate could only be made between plots also retarded in the early growth stages by other included compounds (treatments F and G), no conclusion based on growth or yield could be reached. For various reasons, it is considered that further field trials should be conducted.

At the present stage, the only definite conclusion warranted is that copper and zinc supplies of the soil investigated are insufficient for wheat crops and that the use, with superphosphate, of certain compounds containing these elements can give considerably increased yields. At present prices, the cost of the copper sulphate used was about 6s. 3d. per acre and of the zinc sulphate 1s. 3d. per acre making a total additional cost of about 7/6 per acre. In view of the increased yield obtained, the use of these compounds is definitely warranted for wheat production.

In other areas within the State, it has been found possible to replace copper sulphate (bluestone) by oxidised copper ore which is a cheaper source of copper. Furthermore, experiments with flax have indicated the zinc sulphate can be replaced, as a source of zinc, by the cheaper zinc oxide. However, these substitutions have been made, for the most part, on slightly acid soils. Whether the cheaper but less soluble sources of copper and zinc will be effective on the alkaline Dongara soils under consideration remains to be determined. In this connection, Teakle (1942) suggested that, under such alkaline conditions, the availability of copper and zinc, even when added as the soluble copper and zinc sulphates, might be low and better results might be obtained from the use of increased quantities.

Further experiments are therefore necessary with this soil type to determine whether greater quantities of zinc and copper can be used to advantage, whether zinc sulphate and copper sulphate can be replaced by cheaper sources of these elements such as by zinc oxide dust and by oxidised copper ore, whether the use of potash in addition is profitable, and whether superphosphate can be used in lesser quantities. It is hoped that some or all of these items can be investigated during the coming season.

SUMMARY.

An account is given of a fertiliser trial with wheat wherein a number of mineral elements were used in various combinations with superphosphate.

The yields showed statistically significant responses when copper and zinc were used individually with superphosphate. A more striking increase in yield was obtained when zinc and copper were used together with superphosphate.

Due to an inhibiting effect on early growth, presumably due to other compounds with which it was used, it was not possible to determine whether the addition or potash fertiliser has an effect on yield.

For the same reason a definite conclusion concerning the necessity of superphosphate for maximum yields has not been possible.

ACKNOWLEDGMENT.

Grateful acknowledgment is made of the assistance of Mr. J. M. Steele on whose property the experiment was conducted and by whom the necessary operations were so accurately performed.

REFERENCE.

Teakle, L. J. H.: Experiments with Micro-elements for the Growth of Crops in Western Australia. *Jnl. Agric. West Australia,* 19:242-253.

VETCH SEED AS STOCK FOOD.

A further Note concerning the possible presence of poisonous substances.

L. C. SNOOK, Animal Nutrition Officer.

IN the December, 1947, issue of this Journal the composition and food value of locally grown leguminous seeds was discussed. Attention was drawn to the possibility that selected strains of the common vetch may prove a very valuable source of protein-rich seed. This seed could be fed off by sheep in the manner now practised with field peas or lupins, or the crop could be harvested so that the seed could be fed to dairy cattle or poultry.

The warning was given, however, that some strains of vetch have seeds which may at times prove poisonous. Tests are therefore being carried out to make sure that none of the varieties which have shown such promise under our Wheat Belt conditions, are in any way dangerous to stock.

A bulk sample of vetch seed (*V. sativa,* Hawkesbury strain) grown at Wongan Hills Research Station in 1947 was forwarded to the Animal Health Laboratory at Nedlands for thorough testing. The results indicate that the seeds of this vetch are harmless.

Chemical tests indicated that the seed grown at Wongan Hills contained only a trace of the cyanogenetic glucocides which may sometimes render vetch seed poisonous. Analyses carried out by the Government Chemical Laboratories showed that less than 0.01 per cent. hydrocyanic acid (HCN) could be distilled from the seeds. This is an insignificant amount and feeding tests seemed a waste of valuable seed.

However, to make certain that no other dangerous substances were present, vetch seed was fed ad lib to hungry sheep and fowls.

A wether placed in a concrete pen did not at first eat the vetch seed readily but when mixed with a little bran, ten pounds of seed were consumed in ten days. No symptoms of ill-health were observed, the wether looking well when released.

Two cockerels were starved for two days and then offered crushed vetch seed. This was not eaten readily unless mixed with damp pollard. In a week the birds ate 10 oz. of the vetch seed. No ill effects were observed.

There seems every reason to hope that the strain of common vetch now being developed at the Wongan Hills Research Station is relatively free from the dangerous cyanogenetic glucocides which have been reported in some varieties. A strain (W156) selected for seed yield at Muresk, in contrast, was found to contain 0.03 per cent. of hydrocyanic acid in the dry matter. Even at this level the seeds are hardly likely to prove in any way dangerous but obviously it is wise to develop the strains which contain least cyanide. It seems that the Hawkesbury strain is a particularly safe one.

In the December Journal it was shown that the various leguminous seeds are very uniform in composition, from year to year and when grown under a variety of conditions. It is therefore interesting to note that the vetch seeds grown at Wongan Hills in 1947 were very similar in composition to those grown in 1946. In both years less than 0.01 per cent. hydrocyanic acid could be detected in the seeds.

NEW ZEALAND BLUE LUPINS.

COMMENTS ON THEIR VALUE AS STOCK FOOD.

L. C. SNOOK, Animal Nutrition Officer.

IN the December, 1947, issue of this Journal, in an article on the food value of leguminous seeds, the author was rather cautious in recommending the growth of New Zealand Blue Lupins as a source of food for sheep.

A number of farmers has since written to the Department describing the excellent results obtained where this legume has been grown for sheep feed. It was very pleasing to receive this enthusiastic evidence that the New Zealand Blue Lupin has proved so successful in the wetter portions of the State.

With the writer's permission I would like to quote a few of the remarks received in letters, because these will be of great value and interest to other farmers.

Mr. G. V. Mitchell of Bickley Park, Donnybrook, has been growing New Zealand Blue Lupins for six (6) years. At first the sheep had to be taught to eat the seeds but now the trouble is to keep sheep out of the lupin paddocks. Mr. Mitchell has found lupins an excellent crop with which to smother bracken. The fern was rolled with a heavy angle-iron roller, burnt at the end of summer, and sown during April and May with oats and lupins. The rate of seeding was:—Oats 60 lb., lupins 30-45 lb., superphosphate 200 lb. per acre. The field was stocked until the lupins were nearly in flower and then shut up. The lupins then completely smothered the bracken fern, producing an enormous crop of seed for the sheep during the summer. The wool returns have greatly improved since lupins have been grown.

A farmer of Mundijong is another who has found New Zealand Blue Lupins a great success. His only complaint is that the plants are "too palatable." In his experience, sheep will eat out the growing lupins if given the opportunity. The dried plant material seems equally palatable, only very thick stalk stubs being left unconsumed. On this property the lupins grew to a height of five feet and were so thick as to prevent anyone walking through. No evidence of any toxic symptoms have ever been observed in sheep eating these lupins. In New Zealand lupins are grown extensively as green feed but it seems that this strain needs some protection while it is growing.

It is very apparent that the New Zealand Blue Lupin may be used to great advantage by sheep farmers, as well as orchardists. The seed is much cheaper than the local strain and this should encourage its greater use in the wetter areas where the West Australian Blue Lupin does not thrive. It has possibilities also as an annual fodder crop in place of field peas.

There seems to be no doubt about the plants or the seed being palatable. The fact that the green plant is so palatable may in fact be a disadvantage, but in some cases at least it seems that stock can be admitted during the early part of the growing season. It is also apparent that if the New Zealand Blue Lupin contains any toxic principal, the effect is so insignificant as to be quite out-weighed by the many advantages.

BULLDOZERS FOR WATER CONSERVATION.

By C. W. TOBIN, Dairy Instructor.

THE first demonstration of bulldozer clearing was carried out on Mr. W. Frost's property, Kendenup in January, 1945. In 1947, another important use of the bulldozer was demonstrated on the same property.

Fig. I.
Bulldozer pushing up earth for dam wall.

Fig. II.
Removing material from floor of dam.

Fig. III.
Making the wall.

An earth wall was built across the creek thereby damming a large quantity of water. This is no ordinary dam such as one would expect to see on a farm, but has the capacity to supply a small town with its water requirements for several months.

Practically all farmers at some time or other are faced with a dry season when insufficient water for stock and crops has a disastrous effect on production. Even in the beautiful Kendenup country it is quite obvious that greater water conservation for summer usage would increase production, and it was this fact that prompted Mr. Frost to do something about it. It was not until bulldozers became available on a hire basis to farmers that an ordinary farmer could undertake the financing of a proposition of this size, so this is a very practical demonstration of the part bulldozers are playing, and can play in increasing agricultural production.

Fig. IV.
Levelling the top of the wall.

The machine used was a D7 caterpillar owned by Mr. Hawker of Kendenup. It was worked under Mr. Frost's supervision, building the wall to his specifications. There are still a few details to be completed before the dam is properly finished, however, the main objective, i.e. the holding of a large quantity of water, has been accomplished, and great credit is due to Mr. Frost on his achievement.

Details of the dam are as follows:

The wall is built of earth and clay swept into position with the bulldozer. It is 110 feet through at the base sloping to 10 or 12 feet at the top, and the height 21 feet at the centre. The length of the wall is 140 yards. A six inch pipe and sluice valve is fitted in the bottom of the wall to allow the dam to be emptied when desired. There is, of course, a large spillway at the side to allow flood waters to get away.

Fig. V.
Section of the 420 ft. x 21 ft. wall from the down stream side.
Photo: C. W. Tobin.

Fig. VI.
Looking down stream towards wall 400 yards away.
Photo: C. W. Tobin.

Fig. VII.

Looking up stream from the wall. Approximately 560 yards to furthermost point. Mr. Frost standing at water's edge right.
Photo: C. W. Tobin.

The approximate amount of earth in the wall is 7,000 cubic yards, and this was put into position and packed down by the bulldozer in 110 hours working time.

The measurements when full are approximately: 560 yards long, 140 yards wide, and 18 feet deep at the wall. Depth and width gradually recedes from the wall. Its estimated capacity is over 11,000,000 gallons.

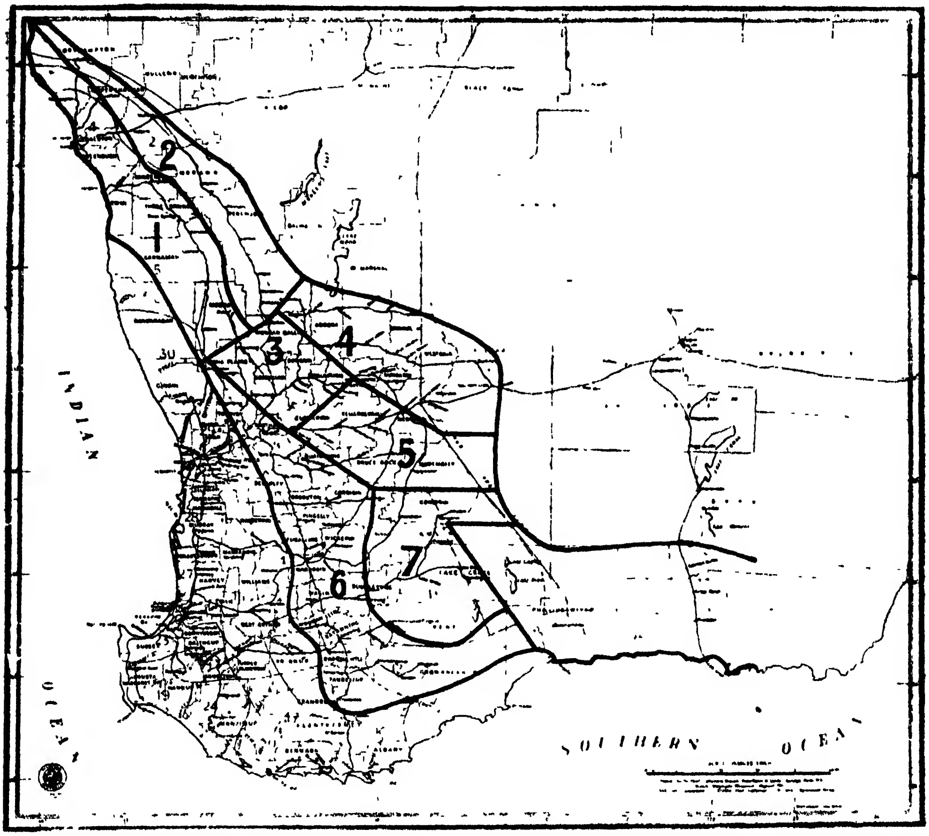
It is yet too soon to say all the uses this water will be put to but some is to be used for irrigating 15 acres of orchard and then probably an area of lucerne will be grown and irrigated.

W.A. FLOUR MILLOWNERS' ASSOCIATION 50 ACRE WHEAT CROP COMPETITION.

I. THOMAS, Superintendent of Wheat Farming.

During 1946 a 50-acre crop competition was sponsored by the Western Australian Flour Millowners' Association and conducted under the auspices of the Royal Agricultural Society and judged by officers of the Department of Agriculture. The whole of the substantial prize money amounting to £495, was donated by the Association.

Crop competitions have been conducted under the auspices of the Royal Society for many years and were a feature of pre-war wheatbelt farming. For the purpose of judging, the wheatbelt was divided in the early years into eight zones, having regard to climatic, seasonal and other conditions. Since 1940, however, Zones 6 and 8 have been amalgamated into one zone, viz. Zone 6. The present seven zones are as shown on the accompanying map.



For the present competition the same zones are used, but the main difference is that with it points are awarded for the baking quality of the flour produced from the wheat obtained from the competing crop. The inclusion of points for baking quality in a wheat crop competition is unique in Australia and possibly elsewhere. The object prompting the W.A. Flour Millowners' Association to provide for this condition was to encourage the production of high yielding varieties of wheat which were also capable of producing good quality flour.

The conditions regarding the awarding of points for baking quality included the provision that no prize was to be awarded to any crop which returned a strength figure of less than 5 minutes as measured on the farinograph. The farinograph is an instrument used in the laboratory for the determination of the baking quality (strength figures) of flours. It was further decided that maximum points for strength would be awarded to all crops which returned a strength figure of 10 or more minutes. This condition was made so that the points awarded for baking quality would not outweigh those for yield. Because of this no advantage could be gained by a competitor entering a crop of a variety having a specially high baking quality. The conditions and details of the competition are as follows:—

Conditions.

(1) The area of each competing crop must be not less than 50 acres of any one of the following standard varieties:—

Bencubbin, Bungulla, Charter, Eureka, Ford, Koorda, Kondut, Merredin, Nabawa, Sutton.

(2) Each competitor will be limited to one entry.

(3) The competition will be judged on the following scale of points:—

a. Yield per acre	50 points
b. Freedom from admixture	10 points
c. Freedom from disease	10 points
d. Baking quality of flour	30 points
Total	100 points

(4) The competition crop must be a compact and unbroken block of not less than 50 acres with straight sides, except on natural boundaries and must be clearly defined before the arrival of the judge by either binder tracks cut or corner pegs showing prominently above the crop. Only the standing crop, the grain of which is recoverable by recognised harvesting practice, is to be taken into consideration.

(5) The competitor must arrange for the judge to be met on arrival of train, conveyed to the plot of wheat, and following inspection, the competitor must convey the judge to the next nearest competitor in his district.

(6) The judge's report will be available for publication.

(7) One bag of wheat from each prize winning crop must be exhibited at the succeeding Royal Show with a card attached showing the points allotted to it.

(8) The entry fee for each crop shall be 5/-. Where District competitions are held, *under similar conditions to this competition,* only the first and second prize winners in such competitions will be eligible to compete. Secretaries of Agricultural Societies conducting such District Competitions must, on or before the 15th September, 1947, forward to the Secretary of the Royal Agricultural Society the entry fee of 10/- to cover the first and second prize winners in their District Competition and later when the names of these place getters are known, forward the names and addresses of these competitors to the Royal Agricultural Society.

(9) All entries must be lodged with the Royal Agricultural Society not later than 15th September.

(10) Prizes are offered as under:—

In each zone, First £40, Second £15. Zone winners will be eligible for State Championship prizes of First £60, Second £30, Third £20.

(11) No prize will be awarded to any variety should the strength figure of its flour be below five minutes as determined on the farinograph, or to any crop awarded less than a total of 60 points.

It will be noted that, as with previous competitions, provision is made for State Championship awards as well as Zone championships.

1946-47 SEASON COMPETITION.

As stated earlier this competition was first conducted during 1946, and in that year a total of 40 entries, inclusive of the first and second prize winners in the local competition conducted by the Merredin district Agricultural Society, was received.

The number of areas actually inspected in order to determine those crops eligible for inclusion in the competition, was 37, but of these only 32 qualified to be considered for the State championship. One crop inspected failed to qualify due to too low baking quality.

The winners of the State Championship awards are as follows:—

1st. J. L. Hughes, Wongoondy, Zone 2 .. .. .. 87 points
2nd. B. M. Caterer, Gnowangerup, Zone 6 .. .. .. 84 points
3rd. E. A. Metcalf, Wyalkatchem, Zone 3 .. .. .. 80 points

All of these crops were of the early maturing variety, Bungulla.

Details of the 1946 State Championship and Zone awards are given in the following tables.

STATE CHAMPSHIP IONAWARDS.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Hughes, J. L. ...	Wongoondy via Mullewa	Bungulla .	40	8	9	30	87
Caterer, B. M. ..	Gnowangerup	Bungulla .	39	8	8	29	84
Metcalf, E. A.	Wyalkatchem	Bungulla .	33	9	9	29	80
Cuming, J. J. and Sons	Korbel via Merredin	Bungulla ...	33	9	9	28	79
Hebberman, H. .	Emu Hill	Bencubbin	33	8	8	29	78
Watkins, A. H.	Karloning via Mukinbudin	Bungulla	28	9	9	30	76
O'Leary, K. J. and C. J.	Walgoolan	Bungulla	29	8	8	30	75
McQuat, W. G. ...	Miling	Bencubbin	29	8	9	28	74
Hebiton, G. B. ...	Mendel via Mullewa	Bungulla .	28	9	8	29	74
Walton, C. B. .	Hyden	Bungulla .	29	8	9	28	74
Smart, E. F. .	Wongan Hills	Bungulla .	28	8	8	29	73
Lynch, T. A.	Hyden	Bungul'a	27	8	8	29	72
Hyde, N. F. .	Waddy Forest via Coorow	Koorda .	24	9	8	30	71

Zone 1

Field Judge—G. L. Throssell, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
McQuat W. G..	Miling	Bencubbin	29	8	9	28	74
Hyde, N. F.	Waddy Forest via Coorow	Koorda	24	9	8	30	71

Zone 2.

Field Judge—G. L. Throssell, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Hughes, J. L.	Wongoondy via Mullewa	Bungulla .	40	8	9	30	87
Hebiton, G. B.	Mendel via Mullewa	Bungulla .	28	9	8	29	74
Heitman, E. G....	Morawa ..	Bungulla	22	9	9	29	69

Zone 3.

Field Judge—E. R. Watson, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Metcalf, E. A.	Wyalkatchem	Bungulla	33	9	9	29	80
Smart, E. F. ...	Wongan Hills	Bungulla ..	28	8	8	29	73
Knapp, J. and Sons	Ballidu . .	Bencubbin	27	7	9	27	70
Fordham, N. A.	Calcarra ...	Bencubbin	21	9	9	26	65
Munyard, A. E. ..	Minnivale ...	Kondut	20	7	9	27	63

Zone 4

Field Judge—E. R. Watson, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Watkins, A. H.	Karloning via Mukinbudin	Bungulla	28	9	9	30	76
O'Leary, K. J. and C. J.	Walgoolan	Bungulla	29	8	8	30	75
Howard, J. H. . .	Gabbin .	Bencubbin	26	9	9	30	74
Perry Bros.	Bencubbin	Bungulla	26	9	9	30	74
Bent, G. . . .	Karloning via Mukinbudin	Bungulla	25	9	9	29	72
Irvine, C. L.	Karloning via Mukinbudin	Bungulla .	23	8	9	30	70
Sticpwich, W. N.	Karloning via Mukinbudin	Bungulla	18	9	9	29	65
Manuel, C. J. .	Mukinbudin	Bungulla	18	8	9	30	65

Zone 5

Field Judge—A. J. T. Marshall, Agricultural Adviser.

Name.	Address.	Variety.	Yield	Freedom From Admixture	Freedom From Disease.	Baking Strength.	Total.
Cuming, J. J. and Sons	Korbel	Bungulla	33	9	9	28	79
Hebberman, H. .	Emu Hill .	Bencubbin	33	8	8	29	78
Teasdale, W. H. and Sons	Merredin .	Bencubbin	30	8	9	29	76
Kay, John .	Baandee	Bungulla	24	8	9	29	70
York, H. S. .	Tammin	Bungulla	21	8	8	27	64
Growden Bros. .	Nangeenan .	Bungulla	18	8	9	29	64

Zone 6

Field Judge—A. J. T. Marshall, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Caterer, B. M.	Gnowangerup	Bungulla	39	8	8	29	84
*King, W. H. ...	Toodyay .	Bencubbin	27	8	9		....

*Did not qualify for an award due to too low Baking Strength.

Zone 7.

Field Judge—H. G. Cariss, Agricultural Adviser.

Name.	Address.	Variety.	Yield.	Freedom From Admixture.	Freedom From Disease.	Baking Strength.	Total.
Walton, C. B.	Hyden . .	Bungulla .	29	8	9	28	74
Lynch, T. A. ...	Hyden .	Bungulla .	27	8	8	29	72
Hall, W. G.	Hyden	Bencubbin . .	28	7	8	28	71
Walton, T. ...	Hyden . .	Bencubbin .	27	9	8	26	70
Lynch, P. J. ...	Hyden ...	Bungulla	27	8	8	26	69
Clayton, R. G. ..	Hyden	Bencubbin ..	23	9	8	28	68
Ray, H. A.	Karlgarin ...	Bungulla	24	8	8	28	68

It will be noted from the above results that some excellent calculated yields were recorded ranging from 18-40 bushels per acre. Five of the competitors obtained a yield of 30 bushels or more per acre and the average for all competitors was a little over 26 bushels per acre. Having regard to the lack of beneficial finishing rains, following upon excessive recordings during the early part of the growing season, the yields obtained must be considered very satisfactory. It is of interest to note that the winning crop for six of the seven zones was of the very early maturing Bungulla, the winning variety in the other zone being Bencubbin.

1947-48 SEASON COMPETITION.

For the 1947 Competition there was a considerable increase in the number of entries, though not as large as anticipated due to the adverse seasonal conditions during August and September. Due to the seasonal conditions also, a number of the entries were withdrawn prior to being inspected. The total number of entries received was 63, inclusive of the first and second prize winners in five local district Agricultural Society competitions.

In order to determine those eligible for inclusion in the competition, including the first and second prize winners in the local competitions, it was necessary to inspect a total of 45 crops. Of these 45, 39 were eligible for consideration in the final judging.

Details of the State Championship awards are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
ZONE 6— Moir, G. R.	Borden	Kondut	44	9	9	26	88
ZONE 1— Bothe, B. D.	Coorow	Bungulla	42	9	9	27	87
ZONE 6— Caterer, B. M.	Gnowangerup	Bencubbin	39	9	9	28	85
ZONE 2— Heitman, E. G.	Morawa	Kondut	40	8	9	27	84
ZONE 1— Morrell Bros.	Narra Tarra	Eureka	40	8	7	28	83
ZONE 2— Chappel, E. J. L.	Bowgada	Bungulla .	34	9	9	29	81
ZONE 3— Alexander, D.	Goomalling ..	Bencubbin ..	34	8	9	26	77
ZONE 5— Latham, A. W.	Narembeen	Bencubbin	29	9	9	27	74
ZONE 3— Watson, R. G.	Wyalkatchem	Bungulla .	31	8	9	26	74
ZONE 5— Cuming, J. J.	Korbel . .	Bencubbin . .	26	9	9	27	71
ZONE 7— Hudson, G .	Newdegate .	Ford .	22	9	9	28	68
ZONE 4— Gobbard & Son	Gabbin . .	Bungulla ...	21	9	9	28	67
ZONE 4— Collins, H. J. ...	Bencubbin	Bungulla	20	9	8	29	66

The yields obtained from all of the above crops must be considered highly meritorious under the rather difficult seasonal conditions experienced in all zones during August and September. Details of the first and second prize winners in the individual zones are as follows:—

Name.	Address.	Variety	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength	Total	Place.
ZONE 1—								
Bothe, B. D.	Coorow	Bungulla	42	9	9	27	87	2
Morrell Bros.	Narra Tarra	Eureka	40	8	7	28	83	5
ZONE 2—								
Heitman, E. G.	Morowa	Kondut	40	8	9	27	84	4
Chappel, E. J. L.	Bowgada	Bungulla	34	9	9	29	81	6
ZONE 3—								
Alexander, D.	Goomalling	Bencubbin	34	8	9	26	77	7
Watson, R. G.	Wyalkatchem	Bungulla	31	8	9	26	74	9
ZONE 4—								
Gobbard and Son	Gabbin	Bungulla	21	9	9	28	67	12
Collins, H. J.	Bencubbin	Bungulla	20	9	8	29	66	13
ZONE 5.—								
Latham, A. W.	Narembeen	Bencubbin	29	9	9	27	74	8
Cuming, J. J.	Korbel	Bencubbin	26	9	9	27	71	10
ZONE 6.—								
Moir, G. R.	Borden	Kondut	44	9	9	26	88	1
Caterer, B. M.	Gnowangerup	Bencubbin	39	9	9	28	85	3
ZONE 7.—								
Hudson, G.	Newdegate	Ford	22	9	9	28	68	11
*Marshall, H. J.	Hyden	Bencubbin	21	9	9			...

*Did not qualify for an award due to too low Baking Strength.

With all the zones some of the calculated yields were quite outstanding, the range of all entries being from 15-44 bushels per acre. Twenty-four of the crops recorded yields of 30 bushels or more per acre and of these 5 yielded 40 bushels or more. The average for all competing crops was a little more than 29 bushels per acre.

These results must be considered highly satisfactory for although the early growth period was very favourable, the August and September conditions were most unseasonable, much below normal rainfall being recorded, with in addition, some excessively severe frosts being experienced. Also, though most districts received late finishing rains, there were a few cases where they were too late to permit of crops benefiting fully.

Full details of the awards in the different zones and the judges' reports are as follows:—

ZONE I.

Field Judge: G. L. THROSSELL, Agricultural Adviser.

In this zone there were 13 entries, including the first and second prize winners in the local competition conducted by the Three Springs District Agricultural Society. Six of the entries were, however, withdrawn prior to inspection.

Points were awarded as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Bothe, B. D. ...	Coorow	Bungulla	42	9	9	27	87
Morrell, Bros.	Narra Tarra	Eureka	40	8	7	28	83
Tunbridge, A. H.	Arrino ...	Bencubbin	40	8	8	26	82
Smart & Tremlett	Mingenew ..	Bungulla ...	37	8	7	28	80
Haeusler, R. C.	Three Springs	Bencubbin	35	8	8	27	78
Morcombe, W. G. & Sons	Coorow	Bungulla	34	8	7	27	76
Chappel, H. H.	Winchester ..	Bungulla	33	8	8	26	75

The winning crop was grown by Mr. B. D. Bothe of Coorow, which, calculated to yield 42 bushels per acre, was very uniform but had lodged badly. This entry, in addition to being awarded first prize in the zone, was placed second in the State Championship. The crop, of the variety Bungulla, was planted during the last week in May at the rate of 60 lb. of seed with 180 lb. of super per acre. It was part of 120 acres of the same variety sown on land originally carrying Salmon Gum timber. For some time this land had been under a four year rotation of fallow—wheat—stubble—pasture.

Second place was gained by Messrs. Morrell Bros. of Narra Tarra with the midseason rust resistant variety Eureka. This crop calculated to yield 40 bushels per acre, was sown at the rate of 60 lb. of seed and 90 lb. of super per acre at the end of May on land which had originally carried York Gum and Jam timber. For the previous ten years the paddock had been down to pasture which included a sprinkling of volunteer subterranean clover introduced by sheep and had been topdressed annually.

Another creditable performance was that of the crop of Bencubbin grown by Mr. A. H. Tunbridge of Arrino, which was calculated to return a yield similar to that of Messrs. Morrell Bros., but the baking quality of the grain was lower.

The rainfall data for 1947 at the centres concerned are tabulated hereunder.

	Jan.	Feb.	Mar.	Apl.	Growing Period. May	June	July	Aug.	Sept.	Oct.	Total	Nov.	Dec.	Total for year
Coorow .	122	..	65	74	285	298	284	89	95	301	1,352	10	.	1,623
Narra Tarra ..	*	*	*	*	436	466	517	190	233	616	2,458	*	*	.
Three Springs ..	28	69	35	116	340	252	286	117	130	298	1,423	10	..	1,681
Mingenew	.	12	64	75	348	260	331	115	179	399	1,632	20	....	1,803
Carnamah .. .	.	141	90	151	318	275	263	103	142	218	1,319	10	...	1,711

* Not Available.

The season generally was a very good one, there being very satisfactory opening rains which were well sustained throughout the winter. Recordings for August were below average and some anxiety was felt. However, late rains in October gave a very good finish to the season, particularly to the heavy yielding crops, though they did tend to cause some lodging, some crops being seriously affected under such conditions.

The competing areas were all of a very high standard. The average calculated yield for all competitors was a little above 37 bushels per acre, ranging from 33 to 42 bushels per acre.

Cultural details for the competing areas are as follows:

Competitor	Bothe, B. D.	Tunbridge, A.H.	Morrell Bros.	Smart & Tremlett.
Years cropped	Old land	Old land	Old land	Old land
Original timber	Salmon Gum	Salmon Gum, York Gum	York Gum, Jam	York Gum, Curara
Ploughed	Late July	August	Middle May, 1947	Early August
Condition of land	Good	Good	Getting hard	Wet
Implement ...	Disc plough	Rigid tyne scarifier	Disc cultivator	Twin disc
Depth	4 in.	4 in.	3½ in.	4 in.
Subsequent .... Cultivations	Scarified August Combined April	Scarified prior to seeding	... .	Combined prior to seeding
Variety	Bungulla	Bencubbin	Eureka	Bungulla
Planted	End of May	End of May	End of May	Mid May
Rate of seed ..	60 lbs.	50 lbs.	60 lbs.	60 lbs.
Rate of super.	180 lbs.	75 lbs.	90 lbs.	112 lbs.
Graded	Yes	Yes	No	Yes
Treatment	Ceresan	Copper carbonate	Nil	Copper carbonate
Type of drill .	Combine	Combine	Sunder seeder	Combine
Disease	.	Trace Rust and Septoria	Take-all	Take-all

Competitor .	Haeusler, R. C.	Morcombe, W. G. & Sons.	Chappel, H. H.
Years cropped	Old land	Old land	Old land
Original timber	Salmon Gum, York Gum and Jam	Salmon Gum, Gimlet	Salmon Gum, Gimlet
Ploughed	March, 47.	July	May
Condition of land	Good	Wet	Good
Implement	Rigid tyne scarifier	Rigid tyne scarifier	Rigid tyne scarifier
Depth . .	3 in.	3 in.	3 in.
Subsequent Cultivations ...		Cross ploughed with disc cultivating plough in September, scarified at end of April	Combined September, October, April. Combined first week of June, reseeded
Variety . .	Bencubbin	Bungulla	Bungulla
Planted . .	Early May	3rd week May	Last week June
Rate of seed .	61 lbs.	60 lbs.	55 lbs.
Rate of super. ..	110 lbs.	112 lbs.	110 lbs.
Graded	Yes	Yes	Yes
Treatment ...	Copper carbonate	Copper carbonate	Copper carbonate
Type of drill	Combine	Combine	Combine
Disease	Trace Take all and Rust	Take-all	Trace Rust

ZONE II.

Field Judge—G. L. THROSSELL, Agricultural Adviser.

There were 13 entries in this zone but 4 were withdrawn prior to inspection. Points were awarded as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Heitman, E. G. ..	Morawa ...	Kondut ...	40	8	9	27	84
Chappel, E. J. L. .	Bowgada	Bungulla .	34	9	9	29	81
Hyde, N. F.	Waddy Forest	Koorda ...	36	9	9	26	80
Collins, H. .	Wubin	Bungulla . .	35	9	9	27	80
Bradford, R.	Damboring	Kondut ..	34	7	8	30	79
McGregor, G. & Son	Menang ...	Bungulla ...	31	9	9	28	77
Hebiton, D. S.	Mendel .	Koorda .	34	9	7	26	76
Harrington, S. C.	Damboring .	Bencubbin	30	7	7	26	70
McAuliffe, F. ..	Mendel ..	Bungulla	30	8	9	...	...

The winning crop was that submitted by Mr. E. G. Heitman of Morawa. This crop, part of 70 acres of the late midseason variety Kondut, was calculated to yield 40 bushels per acre. It had been sown during the second week in May at the rate of 45 lb. of seed and 90 lb. of super per acre. The crop was standing very well at a good stripping height but some slight admixture of another variety due to wash from a neighbouring paddock, was present. The land on which the crop was sown had originally carried Salmon Gum and Morrel timber and had been cleared about 40 years. Of recent years it had been cropped in a two year rotation.

The entry made by Mr. E. J. L. Chappel of Bowgada gained second place and though calculated to yield two bushels per acre less than the competing area of Mr. N. F. Hyde of Waddy Forest, displaced that competitor from second place on account of superior baking quality.

Mr. Chappel's competing area, of the variety Bungulla, was sown at the rate of 55 lb. of seed and 75 lb. of super per acre during the second week in May on former Salmon Gum and Gimlet country which had been under cultivation for many years.

The competitors in this zone returned satisfactory yields and all crops were calculated to yield 30 or more bushels per acre. The calculated average yield for the zone was a little more than 33 bushels per acre.

The rainfall data at the centres concerned for 1947 is as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Morawa	39	17	92	101	217	168	250	66	110	249	1,060	8	3	1,320
Perenjori	40	62	254	52	271	171	290	47	88	212	1,079	....	....	1,487
Wubin	6	..	161	29	204	174	199	79	101	146	903	14	....	1,118
Waddy Forest	0	16	59	70	308	236	256	116	105	212	1,233	30	..	1,408
Ballidu	119	24	150	128	227	222	209	58	103	178	992	2	10	1,425
Mullewa	....	146	107	87	296	138	262	71	98	216	1 081	2	3	1,426

The season generally in this zone was very satisfactory. Excellent germination and early winter rains were experienced but adverse conditions were experienced during August and September and it appeared for a time that the season would finish very badly. With late spring rains, however, the crops made excellent recovery and satisfactory yields were obtained.

Cultural details for the competing areas are as follows:—

Competitor	Heitman, E. G.	Hyde, N. F.	Collins, H.	Chappel, E. J. L.	Hebiton, D. S.
Years cropped. .	Old land	Old land	Old land	Old land	Old land
Timber	Salmon Gum, Morrel	Salmon Gum	Salmon Gum	Salmon Gum, Gimlet	Salmon Gum
Ploughed ...	June—July	August	July	July	End of September
Condition of land	Good	Good	Good	Good	Very hard
Implement	Disc	Disc	Scarifier	Disc	Disc
Depth	4in.	4in.	4—5in.	3in.	2in.
Subsequent Cultivation	Harrowed November and again February Rigid type cultivator in mid-April	Combined September, disc cultivated in February	Combined the first week in April	Disc cultivated September, scarified end of April	Disc ploughed in March
Planted .	2nd week in May	3rd week in May	Mid-May	2nd week in May	Mid-May
Rate of seed ... Rate of super	45lbs. 90lbs.	60lbs. 90lbs	43lbs 103lbs.	55lbs. 75lbs.	50lbs. 90lbs.
Graded	Yes	Yes	Yes	Yes	Yes
Seed treatment	Copper Carb.	Copper Carb.	Ceresan	Copper Carb.	Copper Carb.
Type of drill	Rigid tyne combine	Combine	Combine	Combine	Sunder seeder
Disease .			Trace of Take-all	.	Take-all and Rust
Variety	Kondut	Koorda	Bungulla	Bungulla	Koorda

Competitor	McGregor, G. and Son	Bradford, R	McAuliffe, F.	Harrington, S. C.
Years cropped	Old land	Old land	Old land	Old land
Timber . .	Salmon Gum, York Gum	Salmon Gum, Gimlet	Salmon Gum	Salmon Gum, Gimlet, York Gum
Ploughed	July—August	End of July	August—July	July
Condition of land	Good	Good	Good	Good
Implement	Disc cultivating	Disc	Disc	Disc cultivating
Depth	3in.	4—5in.	3—4in.	3½in.
Subsequent Cultivation		Combined end of August, March and prior to seeding	...	Spring tyne cultivated in October and prior to seeding
Planted	2nd week in May	Mid-May	Early May	1st week in May
Rate of seed ...	60lbs.	45lbs.	60lbs.	50lbs.
Rate of super...	75lbs.	90lbs.	80lbs.	120lbs.
Graded	Yes	Yes	Yes	Yes
Seed treatment....	Copper Carb.	Copper Carb.	Copper Carb.	Copper Carb.
Type of drill	Combine	Combine	Combine	Combine
Disease	..	Trace of Flag Smut and Take-all		Take-all
Variety	Bungulla	Kondut	Bungulla	Bencubbin

ZONE III.

Field Judge—E. R. WATSON, Agricultural Adviser.

Thirteen entries were received for this zone but six of these were withdrawn prior to inspection. Awards were made as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Alexander, D. ...	Goomalling	Bencubbin ..	34	8	9	26	77
Watson, R. G.	Wyalkatchem	Bungulla	31	8	9	26	74
Martin, F.	Cadoux	Bungulla ..	30	7	8	27	72
Knapp, J. & Son	Ballidu	Bencubbin .	28	8	8	27	71
Metcalf, E. G. .	Wyalkatchem	Bungulla ..	25	9	9	27	70
Lines, W. H. .	Ballidu	Bungulla	22	8	7	26	63
Goodie, H. .	Ballidu .	Bungulla .	17	7	9	27	60

The winning entry was that of the crop of the standard midseason variety Bencubbin grown by Mr. D. Alexander on the property of Slater & Co., Goomalling. This crop being part of 135 acres of the same variety, gave a satisfactory calculated yield of 34 bushels per acre and was an exceptionally well grown heavy crop. Despite its height, it stood very well, but showed a few odd heads of another variety. Rate of sowing was 53 lb. of seed with 90 lb. super per acre.

The land had originally carried Salmon Gum and Gimlet timber and had been cleared about 40 years. Of recent years it had been cropped on a three year rotation.

Mr. R. G. Watson of Wyalkatchem, submitted the entry of a crop of the variety Bungulla which gained second place. This crop was calculated to yield 31 bushels per acre. For the most part it was well grown, but it had lodged and was considerably tangled in places. In addition some admixture of a club-headed variety was present. The crop had been sown at the rate of 60 lb. of seed and 110 lb. of super per acre during the last week in May.

Details regarding the rainfall during 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Goomalling ...	7	.	88	165	346	270	196	49	59	147	1,067	59	5	1,382
Wyalkatchem ...	28	75	62	128	207	206	200	29	46	254	942	3	54	1,292
Cadoux	4	20	83	107	263	248	240	85	70	150	1,056	87	2	1,359
Ballidu	119	24	150	128	227	222	209	58	103	173	992	2	10	1,425

In common with other parts of the wheatbelt, the growing conditions during late Autumn and early Winter were most favourable, but during August and September beneficial rains were lacking and the prevalence of heavy frosts caused considerable anxiety. However, excellent rains were experienced in October which resulted in satisfactory yields being obtained. The averaged calculated yield of the competing areas was a little over 26 bushels per acre.

Cultural details of the different competing areas are set out for comparison as follows:—

Competitor ..	Alexander, D.	Watson, R. G.	Martin, F.	J. Knapp & Son.
Years cropped	40 years	20 years	..	25–30 years
Timber	Salmon Gum, Gimlet	Salmon Gum, Gimlet	Salmon Gum, Gimlet	Salmon Gum, Gimlet
Ploughed . .	June	July	Mid July	Early August
Type of plough	Disc	Disc cultivating	Disc cultivating	Disc cultivating
Depth .	4 in.	4 in.	4 in.	4 in.
Other cultivations	Cultivated end of April	Ploughed back in October with same implement and again in April	Ploughed back in September and again in May with same implement	Cultivated in September with spring tyne combine
Variety .	Bencubbin	Bungulla	Bungulla	Bencubbin
Planted	17th May	28th May	26th May	1st week in May
Rate of seed	53 lbs.	60 lbs.	48 lbs	45 lbs.
Graded	Yes	Yes	Yes	Yes
Treated	Copper carbonate	Copper carbonate	Copper carbonate	Copper carbonate
Rate of super.	90 lbs.	110 lbs.	94 lbs.	80 lbs.
Type of drill	Spring tyne combine	Rigid tyne combine	Combine	Spring tyne and rigid tyne combines
Disease			Several patches of Take-all	Several patches of Take-all

Competitor ...	Metcalf, E. A.	Lines, W. H.	Goodie, H.
Years cropped	20 years	28 years	10 years
Timber .	Breaking into Mallee; Salman Gum, Gimlet	Salmon Gum, Gimlet	Sand plain scrub
Ploughed ...	Mid July	Late November	Mid July
Type of plough	Rigid tyne cultivator	Disc cultivating	Disc cultivating
Depth	4 in.	Not known	4 in.
Other cultivations	Disc cultivating plough in early September. Rigid tyne in early May. Combine mid May	Disc cultivating plough just prior to seeding	Rigid tyne cultivated mid May
Variety	Bungulla	Bungulla	Bungulla
Planted	20th May	17th May	7th June
Rate of seed ..	50 lbs.	56 lbs.	50 lbs.
Graded	Yes	Yes	Yes
Treated	Copper carbonate	Copper carbonate	Copper carbonate
Rate of super.	90 lbs.	95 lbs. (top-dressed 1946, 65–70 lbs.)	112 lbs.
Type of drill	Rigid tyne combine	Combine	Combine
Disease	...	Patches of Take-all and some Flag Smut	..

ZONE IV.

Field Judge—E. R. WATSON, Agricultural Adviser.

In this zone there were only 3 competitors, including the first and second prize winners of a local competition conducted by the Mt. Marshall District Agricultural Society.

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Gobbard & Son	Gabbin	Bungulla	21	9	9	28	67
Collins, H. J. ...	Bencubbin	Bungulla	20	9	8	29	66
Watkins, A. H. ...	Karloning	Bencubbin	15	9	9	28	61

The winning crop, entered by Messrs. Gobbard & Son of Gabbin, was of the variety Bungulla sown on former Salmon Gum and Gimlet timber country and cropped on a 3-year rotation. It had been planted during the third week in May at the rate of 45 lb. of seed with 90 lb. of super to the acre and returned a calculated yield of 21 bushels per acre.

Mr. H. J. Collins' entry, also of the variety Bungulla, which gained second place, was down and tangled in places and showed patches of "Take-all". This crop was planted at the end of April at the rate of 50 lb. of seed and 100 lb. of super to the acre on former Salmon Gum, Ti-tree and Mallee timber country which of recent years had been cropped on a 3-year rotation.

The crop of Bencubbin entered by Mr. A. H. Watkins of Karloning had suffered considerably from drought conditions.

Rainfall figures during 1947 for the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Gabbin ..	33		450	86	196	221	158	78	82	125	860	36	.	1,465
Bencubbin .	34	15	277	59	159	200	151	57	69	177	813	103	.	1,301
Karloning	75	29	90	63	159	157	163	63	95	179	816	20		1,093

The season started off well but the lack of beneficial rain during August and September seriously affected the crops and practically all entries at the time of inspection showed the effects to a greater or lesser extent. Frosts were widespread during the winter months, but little damage was evident in the grain.

The average yield of all the competitors in the zone was just over 18 bushels per acre, and having regard to the growing conditions this must be considered satisfactory.

Cultural details are as follows:—

Competitor	Gobbard and Son	Collins, H. J.	Watkins, A. H
Years cropped ...	25 years	25 years	14 years
Timber	Gimlet and Salmon Gum	Salmon Gum, Ti-tree, Mallee Scrub	Salmon Gum, Black Mallee
Ploughed .	July	August	July
Type of plough	Disc	Disc	Disc cultivating
Depth . .	3in.	2½in.	4 –5in
Other cultivations	Ploughed back in September, ploughed again in April	Cultivated just prior to seeding with spring tyne combine	Ploughed back with disc cultivating plough in September. Cultivated with Rigid tyne late April
Variety	Bungulla	Bungulla	Bencubbin
Planted	17th May	End of April	3rd to 10th May
Rate of seed	45lbs.	50lbs	39lbs.
Graded .. .	Yes	Yes	Yes
Treated .	Copper Carbonate	Copper Carbonate	Copper Carbonate
Rate of super	90lbs.	100lbs	90lbs
Type of drill	Rigid tyne combine	Spring tyne combine	Spring tyne combine
Disease		Slight Take-all infection	

ZONE V.

Field Judge—A. J. T. MARSHALL, Agricultural Adviser.

There were six competing areas submitted to the judge for inspection. Final awards were made as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture	Freedom from Disease.	Baking Strength	Total.
Latham, A. W.	Narembeen	Bencubbin	29	9	9	27	74
Cuming, J J. & Sons	Korbel	Bencubbin	26	9	9	27	71
Hebbermann, H.	Emu Hill .	Bungulla	26	8	9	26	69
York, H S.	Tammin	Bencubbin	25	8	9	26	68
Jacob, H. S.	Belka	Bungulla	22	9	9	26	66
Quick, H. E.	Collgar	Bungulla	23	9	9		

Mr. A. W. Latham's crop of the variety Bencubbin was part of 100 acres of the same variety sown on land which had originally carried Salmon Gum and Gimlet timber and cropped in a four year rotation of fallow, wheat, oats, pasture. The crop was calculated to yield 29 bushels per acre and had been sown on the 18th May with a combine at the rate of 43 lb. of seed and 93 lb. super per acre.

The entry which gained second place was that of the variety Bencubbin grown by Messers. J. J. Cuming and Sons of Korbel which returned a calculated yield of 26 bushels per acre. Grown on former Salmon Gum Gimlet timber country, this crop had been sown on 14th May at the rate of 60 lb. seed and 112 lb. of super per acre.

The details regarding the rainfall during 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May	June	July	Aug.	Sept	Oct	Total	Nov.	Dec.	Total for year
Narembeen	3	8	35	202	219	255	164	59	67	237	1,001	74	4	1,327
Belka	....	55	73	150	203	254	193	70	51	241	1,012	40	..	1,330
Emu Hill	....	6	45	171	212	281	177	60	56	168	954	95	*	
Tammin	....	4	20	168	238	297	228	58	86	173	1,080	42	..	1,314
Merredin	7	2	95	110	180	253	191	51	78	215	968	68	11	1,261

*Not available.

Crops in this zone must be considered highly satisfactory particularly when it is remembered that in August and September a prolonged dry spell coupled with severe frosts, was experienced and much anxiety was being felt as to the harvest prospects.

For all crops in the competition, the calculated average yield was slightly over 25 bushels per acre.

Cultural details for the entries are set out for comparison as follows:—

Competitor ..	Latham, A. W.	Cuming, J. J. and Son	Hebbermann, H.
Years cropped	Over 20 years	Over 20 years	30 years
Timber	Gimlet and Salmon Gum	Salmon Gum and Gimlet	Salmon Gum, Gimlet and Morrel
Ploughed .	June	June	July
Type of plough	Mouldboard	Disc	Mouldboard
Depth	4in.	3in.	3in.
Other cultivation	Combined in August, March and May	Scarified in August and May	Cultivated in September and May
Condition of land at ploughing	Wet	Wet	Boggy
Variety	Bencubbin	Bencubbin	Bungulla
Planted .	18th May	14th May	24th May
Rate of seed .	43lbs.	60lbs.	45lbs.
Seed graded and pickled	Yes	Yes	Yes
Rate of Super	93lbs.	112lbs.	150lbs.
Type of drill	Spring tyne combine	Rigid tyne combine	Spring tyne combine
Disease			

Competitor .	York, H. S	Quick, H. E.	Jacob, H. S
Years cropped ...	30 years	Over 15 years	Not known
Timber	Salmon Gum, Gimlet and Mallee	Salmon Gum, Gimlet and Morrel	Salmon Gum, Gimlet
Ploughed	5th—18th July	July	July
Type of plough	Disc	Disc	Scarifier
Depth	3½—4in.	4in	3in
Other cultivation	Cross ploughed September, cultivated 8th May	Scarified September and May	Scarified August and April
Conditions of Land at Ploughing	Wet	Dry and hard	Moist (Good)
Variety	Bencubbin	Bungulla	Bungulla
Planted	25th-29th May	End of May	10th May
Rate of seed .	55lbs	45lbs.	45lbs.
Seed graded and pickled	Yes	Yes	Yes
Rate of super	90lbs.	90lbs.	110lbs.
Type of drill ...	Spring tyne combine	Spring tyne combine	Spring tyne combine
Disease	....	...	....

ZONE VI.

Field Judge—A. J. T. MARSHALL, Agricultural Adviser.

There were five competitors in this zone and the awards made are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total
Moir, G. R.	Borden	Kondut	44	9	9	26	88
Caterer, B M.	Gnowangerup	Bencubbin	39	9	9	28	85
Murray, A .	Tinkurrin	Bencubbin	32	9	9	26	76
Hams, T H.	Gnowangerup	Bencubbin	32	9	9	25	75
Jefferis, J.	Wagin	Bungulla	38	9	9		

Mr. Gerald Moir's crop of the variety Kondut was outstanding, and in addition to winning first prize in this zone, gained the State Championship award. This crop, sown at the rate of 45 lb. of seed and 90 lb. of super per acre on the 28th May was tall, dense, and very even. The original timber on this red loam land was York Gum and Jam and had been cropped for 20 years on a three-year rotation of fallow-crop-pasture.

The entry which gained second place was a crop of the variety Bencubbin grown by Mr. B. M. Caterer of Gnowangerup. This, another excellent crop, returned a somewhat lower calculated yield than Mr. Moir's Kondut but obtained higher points for baking quality.

This crop had been planted on 21st May on former Morrell and York Gum timber country at the rate of 60 lb. of seed and 112 lb. of super per acre. This competitor also gained third place in the State Championship award.

The crop entered by Mr. J. Jefferis of Behn-Ord estate was calculated to yield 38 bushels but as the strength figure of the grain as determined by the farinograph, for baking quality, was less than five minutes, it could not qualify for the State Championship.

Rainfall data for 1947 at the centres concerned are as follows:

	Jan.	Feb	Mar	Apl.	Growing Period.							Nov	Dec.	Total for year
					May	June	July	Aug.	Sept	Oct	Total			
Borden	6	62	15	279	237	356	166	103	156	321	1,339	96	6	1,803
Gnowangerup ..	4	75	1	490	256	421	169	80	120	274	1,320	64		1,956
Nippering ..	2	73	39	259	316	451	136	72	118	207	1,300	16	9	1,698
Wedin	4	59	5	261	316	369	131	140	75	279	1,310	27	18	1,684

Although dry conditions prevailed during August and September the growing conditions for the season would be considered satisfactory, particularly as copious rains during October were in time to fill out the heavy yielding crops. The crops in these areas normally mature somewhat later than is the case in other zones.

Cultural details of competing areas are as follows:—

Competitor.	Moir G. R.	Caterer B. M.	Jefferis J.	Hams, H. T.	Murray, A.
Years cropped .	20 years	Not known	4th crop, not known	40 years	3 crops in 11 years
Timber .	York Gum and Jam	Morrel and York Gum	Salmon Gum, Morrel, York Gum Jam	Morrel and York Gum	Salmon Gum, Morrel, York Gum, Jam
Ploughed	July	July	August	Mid July	April
Type of plough	Scarifier	Mould board	Scarifier	Scarifier	Scarifier
Depth of ploughing	3 in	3-4 in.	3 in.	3 in.	3 in.
Other cultivations	Disc ploughed, October. Scarified April, Scarified May	Cultivated October, December, April	Scarified November, Scarified April	Disc ploughed, August. Scarified April	Cultivated end of April
Variety	Kondut	Bencubbin	Bungulla	Bencubbin	Bencubbin
Planted	28th May	21st May	3rd June	20th May	27th May
Rate of seed	45lb	60lb	45lb	60lb	50lb
Graded and pickled	Yes	Yes	Yes	Yes	Yes
Rate of super	90lb	112lb	100lb	120lb	90lb
Type of drill	Rigid tyne combine	Spring tyne combine	Spring tyne combine	Rigid tyne combine	Rigid tyne combine
Disease					

ZONE VII.

Field Judge—A. J. T. MARSHALL, Agricultural Adviser.

There were six entries in this zone, including two nominated by the Karlgarin District Agricultural Society. However, owing to withdrawals only two remained at the time of inspection. The points awarded are as follows:—

Name.	Address.	Variety.	Yield.	Freedom from Admixture.	Freedom from Disease.	Baking Strength.	Total.
Hudson, G.	Newdegate	Ford	22	9	9	28	68
*Marshall, H. J.	Hyden .	Bencubbin .	21	9	9		. .

*Did not qualify for an award due to too low Baking Strength.

Mr. G. Hudson's entry of the midseason variety Ford was the winner with a calculated yield of 22 bushels per acre.

The competing area had been planted during the second week in May on former Salmon Gum, Blackbutt, and Mallee timber country, which for some years had been cropped on a fallow-wheat-oats two-years pasture rotation.

The entry made by Mr. H. J. Marshall with a crop of the variety Bencubbin was calculated to yield one bushel per acre less than Mr. Hudson's crop but the baking quality did not reach the required standard and was, therefore, not eligible for a prize.

The rainfall data for 1947 at the centres concerned are as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May	June	July	Aug.	Sept.	Oct.	Total			
Newdegate	...	78	111	188	136	243	155	40	71	218	863	62	15	1,317
Hyden	3	66	46	171	135	203	170	63	72	158	801	32	....	1,119

Cultural details for the competing areas are as follows:—

Competitor.	Hudson, G.	Marshall, H. J.
Years cropped	5 crops in 19 years	17 years
Original timber	Salmon Gum, Blackbutt, Mallee, Morrel	Salmon Gum, Gimlet, Mallee.
Ploughed	July, August	August
Condition of land	Fairly good	very wet.
Implement	Disc	Disc
Depth	3–4 in	4 in
Subsequent cultivations	Scarified in late April	Cultivated late March–April
Variety	Ford	Bencubbin
Planted	2nd week May	1st week in May
Rate of seed	50lb	42lb
Rate of super	120lb	90lb
Graded and treated	Yes	Yes
Type of drill	Spring tyne combine	Spring tyne combine
Disease		

DISCUSSION.

THE conducting of wheat crop competitions serves a very useful purpose in connection with advisory work to wheatbelt farmers. From a study of the results of the cultural and other operations carried out by the individual competitors, the reasons for the high yields quite often obtained, can be assessed. There are also a number of interesting points which arise from perusal of the results and data available.

As indicated earlier, this competition is unique in that the factor of baking strength is taken into consideration in determining the awards made. From time to time doubt is expressed as to the quality of the wheats being grown in this State, with particular regard to the standard wheats most commonly grown. With both seasons' competitions, the varieties included were all of the standard varieties and each year those included were planted to over 60 per cent. of the area sown to

wheat for all purposes in Western Australia. Details of the number of crops sown to the different varieties in each of the zones and in each year, are set out in the following table:—

	Bencubbin.		Bungulla.		Eureka.		Kondut.		Koorda.		Ford.		Total.	
	1946	1947.	1946.	1947	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.
Zone 1	1	2		4		1			1				2	7
Zone 2		1	3	4				2		2			3	9
Zone 3	2	2	2	5			1						5	7
Zone 4	1	1	7	2									8	3
Zone 5	2	3	4	3									6	6
Zone 6	1	3	1	1				1					2	5
Zone 7	3	1	4									1	7	2
Total	10	13	21	19		1	1	3	1	2		1	33	39

It will be noted from the above table that in each year approximately one-third of the crops were sown to Bencubbin and 60 per cent. to Bungulla. These two varieties are the main standard wheats grown in this State, at present being used for just over 54 per cent. of the acreage. Of the other varieties grown, the performances of the late midseason variety Kondut, must be considered very meritorious as in 1947 in addition to winning the State Championship, it was the winner in two zones. This variety is particularly useful for sowing on ploughed up clover land, on light land and under high rainfall conditions. The variety Koorda is the early maturing counterpart of Kondut and has achieved quite considerable popularity over the last few years.

Eureka is a midseason maturing rust resistant variety which of recent years has unfortunately been found to be susceptible to a new biotype of rust race 34.

In connection with the baking strength of the grain of the individual crops, the details of the number of crops in each zone gaining 25 points or more in each of the two years, are set out below:—

Points	30		29		28		27		26		25		*Nil*	
Year	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947.	1946.	1947	1946.	1947.
Zone 1	1				1	2		3		2				
Zone 2	1	1	2	1		1		2		3				1
Zone 3			2				2	4	1	3				
Zone 4	6		2	1		2								
Zone 5			4		1		1	2		3				1
Zone 6			1			1				2		1	1	1
Zone 7			1		4	1			2					1
Total	8	1	12	2	6	7	3	11	3	13		1	1	4

It will be noted from the above table that in 1946, 26 of the competing crops gained 28 or more points, but in 1947 only 10. In 1946 20 crops gained 29 or more points, but in 1947 only three.

It will also be noted that in 1946 in Zone 4, six crops gained the maximum points and the other two 29. Of these crops seven were of Bungulla and one of Bencubbin, the Bencubbin gaining the maximum points. Maximum points were also gained by the crop of Bungulla which won the State Championship.

It should be noted also that in that year only one crop failed to become eligible for consideration for an award. This crop, of the variety Bencubbin, was grown under higher rainfall and lighter soil conditions than most of the other crops of that variety.

With the 1947 competition, the baking strength factor had a definite bearing not only on some of the place getters, but in two zones the returning of good strength figures determined whether or not some of the competitors would be eligible for inclusion in the competition results. With this year also, four crops failed to become eligible for an award due to their returning strength figures of less than five minutes, as determined upon the farinograph.

The finishing conditions in the two seasons were totally different, inasmuch as in 1946 there was a lack of beneficial finishing rains, whereas in 1947 most districts received good late finishing rains. The receival of these good rains would have a lowering effect on the baking strength of the crops, whereas the previous year the hard finishing conditions were conducive to higher strength figures.

These results clearly indicate that the strength of the grain of any variety is dependent not only upon its inherent capacity for strength, but also the soil, environmental, and climatic conditions. It will, therefore, be seen that under suitable soil and climatic conditions, the standard Western Australian varieties are capable of producing grain of "Filler" strength.

With regard to cultural operations, the following are brief comments on the individual phases:—

Fallowing.

In 1946 all of the crops were planted on land which had been fallowed the previous year, but in 1947 two were planted on ploughed up land. Both of these crops returned excellent yields one, of Eureka, planted on old pasture land, gained second prize in Zone I and the other of Bencubbin, second prize in the local competition conducted by the Three Springs Agricultural Society.

In the past all the experimental and other evidence has indicated that fallowing for the wheat crops is essential for maximum production. Today with the accent quite largely on pasture improvement and soil conservation, the necessity for fallowing is not always of paramount importance. In some districts, and in the lower rainfall areas in particular, this practice must, however, continue to ensure maximum yields.

The implement most favoured for ploughing was the disc type, approximately two-thirds of the crops in each year being planted on disc ploughed land. The rigid tyne cultivator or scarifier was next favoured and there were only a few areas on which the mouldboard was used.

Time of Seeding.

The time at which the crop is planted is determined firstly, by the maturity of the variety being used and secondly, by the actual seasonal conditions experienced. The planting of a variety at the right time considerably assists in ensuring maximum production within its capacity, but if planted out of season, then yields are likely to be considerably depressed, either due to lack of sufficient growing period or to disease due to early planting.

With regard to the competition itself, the time of planting varied from late April to late June. The major portion (over 90 per cent.), was, however, planted during the month of May. All of the experimental evidence available indicates that May is the most suitable month for the sowing of the wheat crop. Seeding calendars are published from time to time in the Departmental Journal, covering periods for the seeding of the individual recommended varieties.

Rate of Seeding.

The different rates of seeding used by the individual competitors ranged from 30 to just over 60 lb. per acre, but the majority used in the vicinity of 45-56 lb. per acre. This rate is in conformity with the recommendations based on the results of the experimental work carried out over a number of years, which indicated that there was no necessity, except under exceptional circumstances, to use a greater rate than 45 lb. per acre. Most of the crops planted with less than 45 lb. per acre were in the lower rainfall areas where the lower rates have been found to be economical.

Rate of Superphosphate.

The rates of superphosphate used cover the wide range of from 60-180 lb. per acre, but approximately 90 per cent. of the crops were dressed with from 90-112 lb. of super. This is the normal rate recommended for use with the wheat crop.

Disease.

Many years ago one of the main diseases which had to be contended with by the wheat farmer, was Ball or Stinking smut, but through the use of fungicides such as copper carbonate or one or other of the proprietary mercury compounds, little or no ball smut is now found in wheat samples. With all of the crops, the seed used was treated with one or other of the above fungicides.

With regard to the crops as a whole, the evidence of disease was comparatively slight, there being in places some evidence of "Take-all" and to a lesser degree flag smut and septoria. "Take-all" is a disease which causes serious losses in some years and it is pleasing to note that with the competition crops, the incidence was small and the effect on yields slight. The minor presence of these diseases is undoubtedly due to the sound farming practices of the competitors.

With regard to stem rust in wheat, which occurs periodically in epidemic form in some districts, there was practically no evidence of it occurring at all on any crop.

CONCLUSION.

As mentioned earlier wheat crop competitions were an important phase of wheatbelt agriculture in prewar days assisting materially in the improvement of farming practices in these areas and serving as a very useful vehicle in extension and advisory work amongst farmers. The Western Australian Flour Millowners' Association is, therefore, to be highly commended in not only sponsoring the recommencement of such competitions and donating the very substantial prize money, but in having included in the conditions of the awards, points for the baking quality of the flour obtained.

The results of the competition to date will be gratifying to the sponsors, though the entries received might possibly have been greater particularly in view of the magnitude of the awards.

PREPARED BAITS FOR WILD DOGS AND FOXES.

A. S. WILD, Chief Inspector, Vermin Branch.

DURING past years the active measures of farmers and pastoralists, in destroying both foxes and wild dogs on and near their properties, have been hindered by the difficulty in obtaining suitable supplies of material and, in some cases, inconvenience of preparing suitable baits. Many people have an aversion to handling a poisonous material such as strychnine, especially in the powdered form, which was generally used. Also many hastily prepared baits contributed to make wild dogs bait-shy, and therefore increased the difficulties in destroying these animals.

The projected aerial baiting activities in the more inaccessible parts of the State also necessitated that well prepared and easily preserved baits be available in large quantities. Prepared baits have been manufactured in other States, the material used being cooked brisket fat, and the Western Australian Department of Agriculture conducted investigations into the various types of material which might be available for the manufacture of large quantities of baits in this State.

It was obvious that baits when prepared would be eagerly sought by vermin boards for resale to pastoralists and farmers in their areas, and a suggestion was made to Messrs. David Gray & Co. Ltd. that they assist in the investigations and proceed with the manufacture when a suitable formula was decided upon. Through the co-operation of the management of Robbs Jetty Abattoirs supplies of brisket fat were obtained from the boning of beef carcases, and these were saved and treated by cooking in brine solution. The brisket fat was cut into one-inch cubes and at the factory half-grain tablets of strychnine were inserted into each cube. The material was then wrapped in parchment paper and the experimental baits tried out under field conditions. However, supplies of brisket fat available at the abattoirs near Perth were limited and it was decided to investigate the possibilities of using material such as ewe's udder. Experiments eventually indicated the right cooking treatment for this material, which was at least equal to brisket fat, making an attractive bait for dogs, and also with a texture to hold the strychnine tablet firmly in the centre of the bait.

Further experiments have indicated that some modification must be made to the wrapping paper, parchment paper proving too stiff to be easily removed by the wild dogs. Also there is a danger that sufficient odour would not come from baits so wrapped to attract dogs and foxes, which rely so much on the sense of smell. The alternative wrappings suggested for the manufacture of baits are blank newsprint paper and tissue paper somewhat similar to that used for wrapping apples for export. It was desirable that baits should be so wrapped not only as a protection against ants, but also to provide packing in the boxes. A further modification might follow experiments with the colouring of the paper

green, as this colour is less likely to attract birds and therefore will provide a greater economy in baits and reduce the hazard of wholesale destruction of bird life which might be beneficial to agriculture.

The use of strychnine tablets has greatly facilitated the preparation of the baits and this was a great improvement on the old method of roughly measuring the desired quantity of powdered strychnine with its attendant waste and danger. The tablets also avoided the probability of leaving portion on the outside of the baits, which would tend to educate wild dogs to be bait-shy.

The manufacturing firm is now producing the baits at the rate of approximately 15,000 per week and orders have been placed by many local boards and also the Department of Agriculture for large quantities. The baits are packed in cases which hold 1,000, but smaller cases each containing 200 baits are available for sale especially in agricultural areas where quantities used on individual farms will be considerably less than those required in pastoral districts. It is considered likely that the distribution to individual pastoralists and farmers will be made through the local vermin boards purchasing direct from the manufacturing firm. The price will be approximately £4 per 1,000, which is comparable with that charged in Queensland.

COPPER DEFICIENCY OF CEREAL CROPS IN WESTERN AUSTRALIA.

T. C. DUNNE, Plant Nutrition Officer.

THE excellent results achieved, since 1938, by Teakle and various co-workers from the use of copper containing materials as fertilisers, have been recorded in some detail in a number of papers published in previous volumes of this Journal. Inquiries concerning copper deficiency problems are still being received from farmers but unfortunately reprints of most of these articles are no longer available.

It is the purpose of this paper, therefore, to review briefly the information obtained in this State concerning copper as a fertiliser in the hope that it may serve as a guide to those interested in cereal growing.

Where Copper Deficiency May Occur:

Copper deficiency as determined by responses to applications of copper containing fertilisers has been found to occur in widely separated portions of the State. The accompanying map prepared by Teakle in 1942 (Fig. 1) shows the locations where responses have been obtained, either by Departmental experiments or by tests made by farmers.

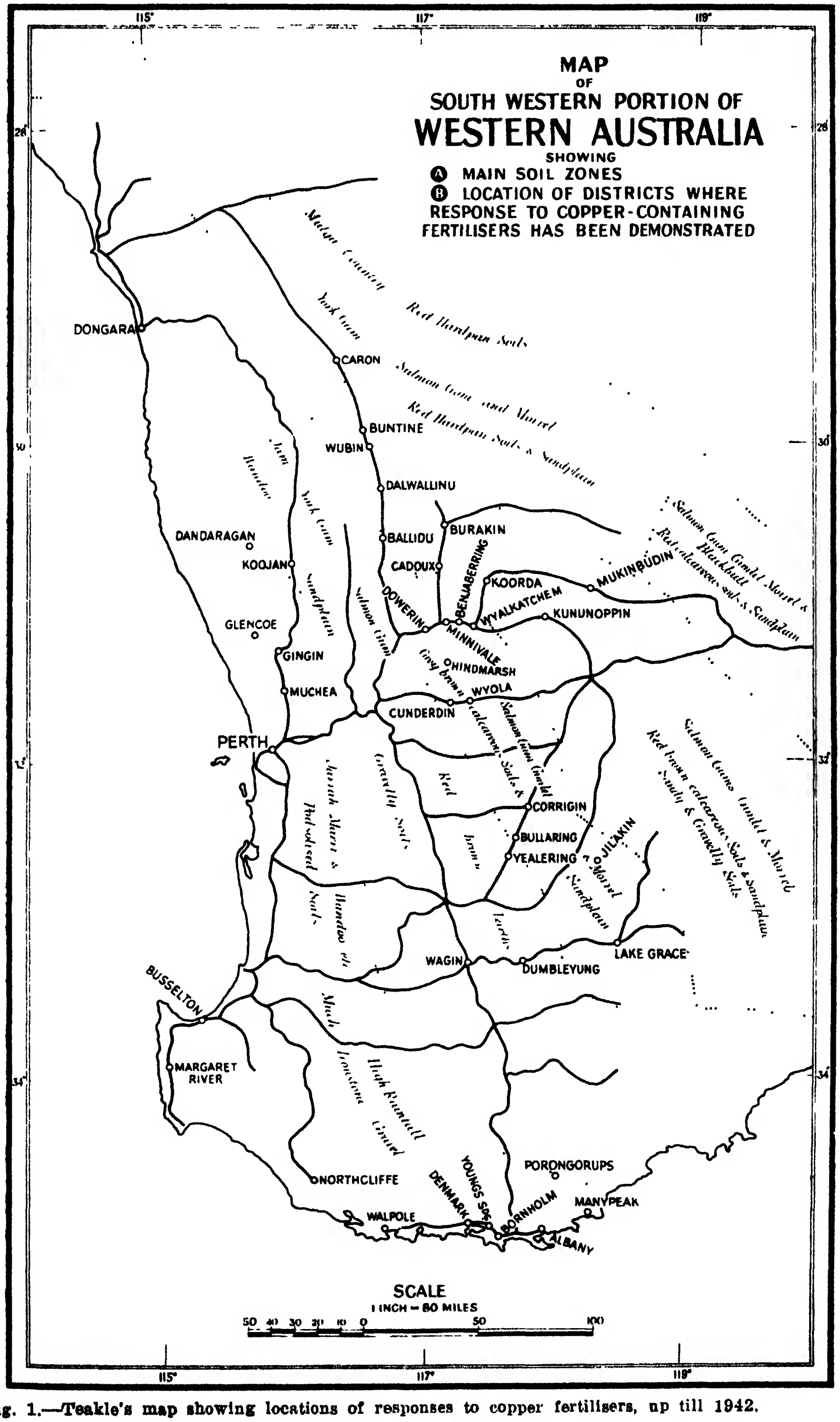


Fig. 1.—Teakle's map showing locations of responses to copper fertilisers, up till 1942.

Certain soil types are more likely to be deficient than others. Brief descriptions are therefore given hereunder of a number of types on which the deficiency may occur:—

1. The high level sandy and gravelly soil types of the main wheatbelt and the Great Southern areas. Both types are, in many instances, underlain with gravel, usually at shallow depth.

   Wodjil scrubs are associated with a number of these deficient areas. Deficiency may also occur on similar soil types which carried tamma, broombrush, mallee or stunted wandoo (white gum). In the more westerly affected areas, jarrah is often dominant in the natural vegetation.

   These sandy and gravelly soils include most of the copper deficient areas on which cereals are grown.

2. The main soil types of the Dandaragan and Gingin districts. Among these are the grey to brown coloured light soils of flats which carried mainly flooded gum, and the red sandy soils normally carrying marri (red gum) and banksia.

Fig. 2.—Bending over of wheat stems due to moderate copper deficiency.

3. Coastal soils high in lime. These include the fine sands associated with limestone or soft lime and on which wattle comprises the chief natural vegetation. Cereals are grown on the Dongara and West Northampton examples of this type.

   Sandy soils of the west coast and the marly peat swamps of the Albany area are also included under this heading.

4. Sandy surfaced soils of the Busselton-Augusta area on which marri and scattered jarrah was the dominant native vegetation.

5. Some of the acidic soil types, often sandy, of the Albany district. As well as peaty swamps, there are included sandy types high in organic matter on which bottlebrush predominated.

Responses to copper containing fertilisers have been obtained on a few areas which do not fit into the above groups but these are of limited extent.

No response to copper has, in general, been observed on the heavier soil types of the wheatbelt.

Symptoms of Copper Deficiency.

The symptoms produced in plants by an insufficient supply of copper vary considerably with the severity of the deficiency. With cereals deficient plants are paler in colour than are normal plants of the same variety and the root development is considerably reduced. A brief summary is made of symptoms for the more important cereals.

(a) *Wheat.*—In the more severe cases, symptoms may be seen when the plants are four to six weeks old. Associated with poor growth, there occurs a yellow tipping of the leaves and a limpness of the foliage. Usually such plants either die completely or, as the older leaves die, new ones are produced. No heads are formed by such severely affected plants.

Where the deficiency is less acute, plants may appear normal till early spring when leaf tipping, failure of the stems to elongate and loose heads with sterile florets are noted. A purplish-grey discoloration of the leaf sheaths gives the stems a dark coloration.

Sometimes, normal growth occurs until November when the deficiency causes the formation of dummy heads, which, because of the absence of grain, stand very erect. Discoloration of the leaf sheaths is fairly general.

Few growth abnormalities may be visible with moderate deficiency but many of the heads are empty or only partly developed. Due to the weakness of the straw partly filled heads may bend over excessively (Fig. 2) or, in some cases, may even snap off.

(b) *Oats.*—In acute cases, paleness and drooping of oats plants may be noticed about four weeks after germination. The tips and edges of the most recently emerging leaves develop a white or light yellow appearance. The tips later die, become coiled and develop a stringy appearance with frayed edges (Fig. 3). This appearance is quite characteristic of the deficiency.

In less severe instances, symptoms appear at a later date. Growth is poor, the internodes are shortened and the straw is weak. Secondary tillers which never mature may appear. If heads are formed, the glumes are frequently white and papery and are empty of grain.

Sometimes, symptoms are not pronounced but yields are low owing to the grain being small and shrivelled. Secondary tillers may be present. Ripening is distinctly delayed.

(c) *Barley and Rye.*—The copper deficiency symptoms of barley are, in many respects, similar to those of wheat. The younger leaves of deficient plants show a whitish or yellowish tipping and a yellow edging. The leaf sheaths are pale and the stems are weak and prostrate. Root development is poor and the plants are easily pulled from the soil.

Rye usually makes better growth than do the other cereals on copper deficient country. Nevertheless, in some areas, the heads may be empty of grain or only the bottom half filled. Secondary growth from the bottom of the plants is frequently seen.

Diagnosis of Copper Deficiency.

Definite diagnosis of copper deficiency is usually difficult unless the trouble is very acute when the small dead plants display the typical symptoms. Poor root development, the presence of dummy heads, the bending over of heads or disappointing grain yields as compared with the vegetative growth, all give ample ground for suspicion but not for certainty.

Unfortunately, analyses of plant material for copper content do not necessarily give reliable information. In the early growth stages such analyses may be useful, but it is often difficult to determine whether plants are small because they are young or because they are stunted.

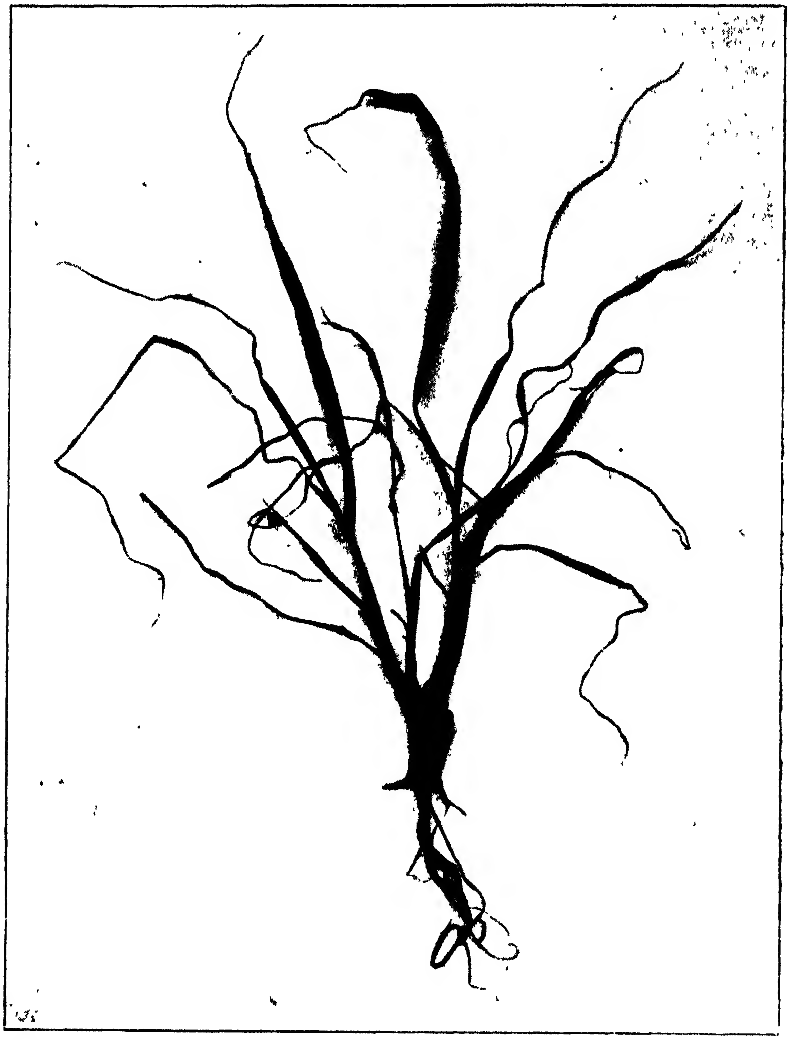


Fig. 3.—Copper deficient oat plant shewing stringy dead tips and poor root development.

Soil analysis is of no use. Differences in responses to copper containing fertilisers may be due, not to variations in copper content, but to differences in availability of that element. At present, there is no reliable test for determining availability.

Where sheep are carried, an examination of the wool may help decide whether trails with copper are warranted. Where the herbage is low in copper, the wool may loose its crimp and bulk and become "stringy" or "steely." If this occurs on areas where some of the plant symptoms described above are noted, trials should be worth while.

The best method is to sow trial strips of copper containing fertilisers across the areas where the deficiency is suspected. Control strips where superphosphate or the customary manurial treatment is applied should be left for comparison, Frequent observations should be made to determine any differences. However,

as copper may affect grain yields without any observable growth changes, it is *essential that the strips be harvested separately* before any conclusion concerning the efficacy of treatment can be reached.

Unfortunately, there do occur instances where the value of added copper may be masked by the fact that some other element is restricting growth. In this connection, a condition was noted recently where the full benefit from copper was obtained only where a zinc compound was applied as well. However, at present, it is believed that areas where this is likely to occur are not common. The copper strip method suggested is therefore suitable for use in most circumstances.

The use of Copper Containing Fertilisers.

In the early experiments conducted to determine responses to copper containing fertilisers, bluestone (copper sulphate) was used at rates up to 20 lb. per acre. Later trials showed that lower rates achieved equally satisfactory results and it was eventually recommended that, on copper deficient soils, bluestone be applied mixed with the superphosphate, at the rate of 5 lb. per acre. Higher rates may cause injury and it has been found that, on a few very sandy types, even 5 lb. per acre could be damaging.

At a later date it was demonstrated that oxidised copper ore could be used as a substitute for bluestone providing the same amount of copper was added per acre. This provision is necessary as bluestone contains about 25 per cent. copper whereas the copper content of oxidised ore usually available may vary from 5 per cent. to 25 per cent., with higher figures from selected samples. If 5 lb. of bluestone (25 per cent.) is to be replaced by a copper ore containing 10 per cent. copper then 12½ lb. of such ore is necessary to ensure that the same quantity of the desired element was being added by each method.

At the present time "copperised" superphosphates are available, which may contain either bluestone or oxidised copper ore as a source of copper. The copper content of both fertilisers is about the same but, as the oxidised ore is the cheaper source, the bulk of the copperised superphosphate available is, where practicable, made by including this latter material.

Data have been also obtained which show that there is a residual effect on subsequent crops of copper applied in previous years. It is therefore recommended that where fertiliser giving the copper equivalent of 10 lb. per acre of bluestone, either as one dressing of 10 lb. or two dressings each of 5 lb., has been applied that no further copper be added, for the purpose of improving plant growth, during the next five years. Sufficient data are not available to decide definitely whether the requirements of animals, are, under all conditions, met by applications spread over such a period. In any case, when the initial soil deficiency has been overcome, annual applications of copper are not necessary.

CONCLUSION.

The benefit to plant growth to be derived from the use of copper on certain soil types has been well demonstrated by the work of investigators during past years. Other workers have shown equally well, the value of this element in animal husbandry.

However, it is necessary that the material, which is not cheap, be used intelligently. Although a number of soil types have been mentioned on which the deficiency occurs, it must be remembered that a great deal of the cereal production of the State takes place on the heavier soils, the clays and loams, which are amply supplied with copper and which give no additional yield with copper fertiliser.

Where deficiency is suspected farmers should make the necessary observations of crops at various growth stages and when in doubt, an attempt should be made, during the growing period of the crop, to obtain the advice of the district agricultural officer.

PHALARIS TUBEROSA.

IN the December 1947 issue of this Journal reference was made to the certification of *Phalaris tuberosa* seed in Western Australia. Photographs have since been received from Mr. F. E. Hitchins showing excellent stands of this grass on his property at Cranbrook.

Mr. Hitchins has co-operated with the Department in carrying out a number of experiments, especially in connection with the "stalling" of subterranean clover. Trials have demonstrated the value of introducing perennial grasses to clover pastures. Besides providing more nutritious and palatable grazing, the grasses reduce the extent of intrusion of such weed species as wild geranium (*Erodium Botrys*) and capeweed (*Cryptostemma calendulaceum*) along with annual grasses which tend to dominate old swards of subterranean clover.

Plate A shows a dense stand of Phalaris sown in 1938. This adjoins a paddock in which the subterranean clover has been replaced entirely by a prolific growth of weeds.

A—Phalaris tuberosa sown 1938.
(Photo: F. E. Hitchins.)

Plates B and C are different views of a paddock sown in 1939. This soon developed into a well balanced pasture of Phalaris and subterranean clover. It was cut for hay in 1945 and harvested for seed in the two subsequent seasons.

As in all crops and pastures the most important factor in success with Phalaris tuberosa, apart from soil and district, is the seed used in the original sowing. Even under the best conditions of soil and cultural practice in an ideal environment, little success can be expected from a pasture sown down with an inferior line of seed. Only by buying certified seed of known purity and germinating capacity can a farmer be sure that the product is of first quality, and capable of producing a pasture of the type desired.

A different approach, and one that has been used with great success by Mr. A. L. B. Lefroy at Chittering, is the selection of seed from a single outstanding plant, as near as possible to the ideal requirements of the species, and the

B.—Phalaris tuberosa sown 1939. Cut for hay 1945. Harvested for seed 1946 and 1947
(Photo. F. E. Hitchins.)

subsequent building up of stocks of the seed as a pure line. About 10 years ago Mr. H. C. Trumble of the Waite Agricultural Research Institute, Adelaide, gave Mr. Lefroy a few seeds from one such plant which he had selected in the pastures at the Institute. During the intervening years Mr. Lefroy has increased his stock of seed, carefully guarding against the possibility of interbreeding between the Waite seed and inferior strains, until now he has 350 acres of excellent pasture all sown with seed derived from the few original ones from the Waite. A section of this pasture is illustrated in Plate D.

The amount of feed provided by the paddock can be gauged from the fact that after fattening one bullock to the acre, Mr. Lefroy still had sufficient feed left to graze a large flock of sheep.

C.—Another view of the paddock shown in "B."
(Photo: F. E. Hitchins.)

D—Section of the 350 acre area of phalaris tuberosa and mid-season subterranean clover.
(Photo. A. L. B. Lefroy.)

WHEAT VARIETY TRIALS.

By I. THOMAS.
Superintendent of Wheat Farming.

THE aim of the cereal breeders is not only to produce a variety which is inherently capable of giving high yields, but which includes in its characteristics resistance to the complex of plant diseases, thus enabling it to produce to its maximum. With respect to disease, plant breeders' efforts at present are directed particularly to the production of rust resistant varieties.

With cereal breeding many promising types result from the crossing of two varieties and the selection of the most suitable necessarily entails comparison with the standard varieties which it is desired they will replace.

In the earliest stages of selection, micro or small scale yield trials are conducted in the plant breeding rows and later the more promising crossbred material is subjected to testing in the larger variety trials under field conditions.

Due to the diversity of soil and climate conditions in Australia, varieties bred in other States, although they may be particularly successful in the State in which they are produced, do not necessarily yield up to their reputation when introduced into other areas with different soil and climatic conditions. As a means of comparison wheat variety trials under field conditions are carried out each year at the Research Stations to test new and introduced varieties, and crossbred material produced at the Research stations against Bencubbin and Bungulla, the standard midseason and early maturing varieties respectively, which between them represent over 56 per cent. of the 1946 acreage sown to wheat for all purposes in Western Australia.

The "pure line breeding" section of the Test Rows which serves to keep varieties breeding true for the varietal characteristics as the initial step in the production of pedigree seed

SEASONAL CONDITIONS.

Seasonal conditions throughout the wheatbelt during 1947 varied considerably and the following is a brief summary of the conditions experienced at each of the Research Stations:—

Brush enclosures at the Merredin and Wongan Hills Research Station, where with the help of irrigation rust epidemics are produced for testing new crossbreds.

Avondale:—Seasonal conditions at this Station were very satisfactory throughout the growing period and crops did not suffer unduly from the dry August-September conditions as in the less favoured districts. The crops definitely benefited from the late finishing rains experienced in October.

Chapman:—At this Station also, germination and early growth was very satisfactory although some crops tended to be rather weedy. Despite reasonably good finishing conditions, yields were not up to expectations.

Merredin:—The early growth period was good but the abnormal low rainfall in August and September, coupled with severe frosts caused a considerable set back to all crops. As a result of beneficial late rains, however, yields were much better than had been anticipated at the end of September.

Salmon Gums:—Although crops were planted under reasonably satisfactory conditions, the season as a whole was rather unfavourable, particularly during August and September. All wheat crops, however, held out well and with the late rains yields were above estimates.

Wongan Hills:—Although the earlier growth period was good at this Station the dry conditions of August and September affected crops somewhat adversely. A good recovery occurred with the rains in October.

Field Day at the Wongan Hills Research Station, 1947 The farm manager, Mr D. R. Bateman, explaining the layout of the wheat variety trials.

Details of the rainfall recorded on each of the Research Stations are given in table No. 1.

TABLE I.

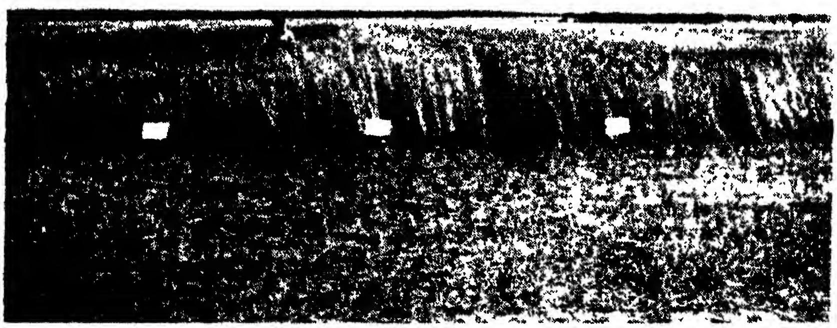
Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
Avondale—														
1947			23	112	226	372	206	67	45	150	1,066	49	7	1,257
Av. 21 y	24	36	101	81	228	335	312	239	99	80	1,294	53	32	1,478
Chapman—														
1947		45	62	143	323	338	321	134	156	365	1,637	19	3	1,909
Av. 42 y	24	37	67	75	236	429	303	264	145	90	1,556	38	26	1,827
Merredin—														
1947	10		95	119	153	231	190	49	52	192	864	68		1,159
Av. 36 y	43	54	96	88	139	196	185	152	80	76	829	42	56	1,208
Salmon Gums—														
1947	4	159	204	168	135	72	80	96	68	206	657	94	7	1,293
Av. 22 y	83	71	144	92	126	150	142	148	92	113	772	89	79	1,331
Wongan Hills—														
1947	46	9	44	91	273	324	224	81	77	212	1,191	41	4	1,426
Av. 22 y	35	46	94	92	195	274	260	200	90	72	1,091	43	41	1,445

Rust Resistance.

Farmers in New South Wales suffered severe losses during the 1947/48 season due to rust epidemics. The variety Eureka which was previously considered to be rust resistant suffered severely due to the fact that it is susceptible to a new biotype of rust race 34, which has developed in the Eastern States during the past few years. Although no wide-spread epidemics of rust have been experienced in this State since 1943 there were localised outbreaks during 1947. These were located on two properties in the Wongoondy district, and as with epidemics in this State (Cass Smith, Millington, 1944) the outbreak of the disease was preceeded by heavy summer rains. An excellent opportunity to study under field conditions the rust reaction of standard and introduced varieties was afforded in a Wheat Variety Trial conducted by Mr. G. L. Throssell, Agricultural Adviser, on one of the affected properties. The Trial included the standard varieties Bungulla and Bencubbin, the New South Wales Department of Agriculture's variety Charter and two cross-breds from the Merredin Research Station, M. 77 and M. 80.

Mr. Throssell's observations are as follows:—

> "The two farms concerned experienced a localised thunderstorm in March when 325 points of rain were recorded. This resulted in an abundant growth of early green feed which was 12in. high in May. The very severe outbreak of rust occurred in September and crops of Bencubbin and Bungulla were almost totally destroyed. Of the two new cross-breds from the Merredin Research Station, M. 80 now registered as Wongoondy proved to be immune and M. 77 highly resistant."



Portion of a Wheat Variety Trial—Merredin Research Station, 1946 Each plot is one-eighth of an acre and is replicated five times in Randomised Blocks.

This substantiates the recommendation of the Department of Agriculture that when nearby paddocks contain self-sown crops heavily infected with stem rust at planting time then an epidemic of that disease during the season is very proable. Losses from rust can be best minimised by having on hand substantial supplies of resistant varieties for planting in such seasons of high rust hazard.

As mentioned previously, in the Eastern States, a strain of rust has appeared which attacks the hitherto resistant variety Eureka and its derivatives. In these States Eureka is no longer regarded as a rust resistant variety.

Fortunately this new biotype of rust race 34 has not as yet been located in this State, but there is little guarantee that it will not eventually be recorded here. In the meantime the Department of Agriculture seeks the co-operation of farmers in the obtaining of rusted wheat plants, and as soon as the disease is observed specimen plants should be forwarded to the Government Plant Pathologist, Department of Agriculture, Perth.

Two new varieties of wheat are being registered by the Department of Agriculture. One of these, Wongoondy (Eureka x Bungulla), tested in Variety Trials as M. 80 derives its rust resistance from Eureka and therefore cannot be regarded as a rust resistant variety except under conditions in Western Australia at present, that is it is susceptible to the biotype or Eureka attacking race of rust. The other variety Dowerin (Sword x Kenya C. 6041) tested in Variety Trials as M. 71 derives its rust resistance from the variety Kenya C. 6041 and is the only variety yet released in Australia with this type of resistance. This variety is resistant to all known races of stem rust in Australia. A further description of these two varieties is given under the heading of "Recommended Varieties."

Kenya C. 6041 is one of the varieties collected from the Kenya colony by the New South Wales Department of Agriculture and the farming industry is deeply indebted to them for their enterprise in collecting varieties in all parts of the world and subjecting them to tests for rust resistance.

Also this Department is very grateful to Drs. Waterhouse and Watson of the Sydney University for their very valuable co-operation and assistance. Prior to the appearance of the biotype of Race 34 of stem rust they made available rust material when necessary to enable the disease to be maintained in the Research Station rust gardens for testing purposes.

However since the new strain appeared and as it would be dangerous to introduce rust material from the Eastern States, they have undertaken the testing of the more promising crossbreds from the Research Stations for resistance to the biotype.

Table No. II which was published in the March Journal, 1941, is here reprinted to illustrate the position of the two new varieties with regard to other resistant varieties.

TABLE II.

Breeder.	Type of Resistance.			
	A. Eureka.	B. Kenya, C6041	C. Kenya, C6042.	Mature D. Plant.
New South Wales Department of Agriculture	Eureka Frisco	... ...	Charter Yalta	Celebration ...
W.A. Department of Agriculture ...	M.78 M.79 Wongoondy M.81	M.70 Dowerin	... ...	... ...
Sydney University	...	...	Gabo Kendee	Hofed Fedwed
Waite Institute	...	...	...	Warigo

Data published by Drs. Waterhouse and Watson form the basis of this table which classifies the types of resistance possessed by the rust resistant varieties now under cultivation in Australia or undergoing advanced trials. For very rust liable areas in Western Australia it would be advisable to have on hand reserves of varieties possessing the B.C. or D. types of resistance rather than the A or Eureka type.

Flour Strength.

One of the primary objectives of the wheat breeding programme in this State is to raise the strength of the West Australian standard wheats to the level that it does not need assistance from or building up by a strong wheat. This strength is referred to as "filler", since after the miller has adjusted the proportions of strong and weak wheats in his blend, he can use an unlimited amount of "filler" wheat without materially altering the strength of the resultant flour. Tests have shown that the popular varieties, Bencubbin and Bungulla, are capable of "filler" strength under suitable soil and climatic conditions and this directs attention to the fact that even though the variety is capable of producing grain of high baking quality this is only possible under favourable soil and climatic conditions. In other words no matter how good may be the variety evolved by the plant breeder, unless the farmer maintains the fertility of his heavier land and builds up the fertility of lighter soil types by use of wider rotations and the inclusion of legumes, such as subterranean clover, peas, lupins, etc., then the variety does not have the opportunity of expressing the true value of its grain quality.

Results have shown that the baking quality of varieties grown on light land can be improved considerably by building up the fertility of the soil with such legumes (Samuel L. W. 1944). Although it is the policy of this Department to release only varieties of improved baking quality in an endeavour to improve the baking strength of the standard wheats part of the responsibility lies with the farmer in his ability to maintain the fertility of his soil.

A comprehensive summary dealing with the various tests for flour strength and a discussion on strength and environment was published in the March, 1947 issue of this Journal.

Variety Trials.

As in previous years rust resistant varieties released in other States were included and five promising cross-bred varieties from the Merredin Research Station, which were tested for the first time in 1946, were again included in these Trials.

As previously stated Variety Trials are a comparison between varieties, the standard variety being the control with which other varieties are compared under similar conditions of soil and climate. As there is a diversity of soil types even in small areas experimental plots are randomised in an endeavour to overcome as many yield differences due to soil type as possible.

Also as it is not possible to obtain accurate data from one set of plots only, each treatment is repeated five times and an average yield taken for the five plots. It is the standard practice on Research Stations in the wheatbelt of this State that each plot be 1 drill width (15 links wide) and 10 chains long, the plots being planted wheel on wheel thus leaving a narrow unplanted buffer between adjacent plots. At harvesting the plots are reduced in length to 833 links giving an area of one-eighth of an acre harvested and the yield per acre computed for each variety.

Cross Breds.

M. 70—Sword x Kenya C.6041—Early maturing, tall growing variety which is resistant to all known races of rust in Australia. It is similar to Dowerin (M. 71)

M. 77 and 78—Bencubbin x Eureka—These early maturing varieties have given promising yields and are being retained for further trial. M. 77 is apparently segregating for rust resistance as there was a slight infection in the Wongoondy trials. At Merredin M. 77 usually yields flour which approaches premium standard, while M. 78 is even stronger. Both have satisfactory straw strength.

Recommended Varieties.

With regard to maturity standards it is customary in Western Australia to classify wheat varieties into four standard maturity groups relative to the early maturing variety Gluyas Early.

1. Very early maturing, flowering five or more days earlier than Gluyas Early.
2. Early maturing, flowering four days earlier to 3 days later than Gluyas Early.
3. Midseason maturing, flowering four to nine days later than Gluyas Early.
4. Late or late midseason, flowering ten or more days later than Gluyas Early.

The following are short descriptions of the recommended varieties included in the 1947 Variety Trials:—

Midseason.

Bencubbin.—This is the standard midseason variety which is the most extensively grown variety in Western Australia and also in Australia. Straw strength tends to be weak on light land, but is satisfactory for hay. Bencubbin is noted for its high yields under inferior seasonal conditions but has been replaced by Bungulla by many farmers in the lower rainfall areas. It still remains the most prolific midseason variety for the Western Australian wheatbelt. It is resistant to flag smut but very susceptible to rust. Its flour strength is equal to the State f.a.q.

Kondut.—Has yielded well at Avondale over the last two years, but generally returns have been below Bencubbin. It is strong strawed and is recommended for planting on ploughed up clover land, on light land and under high rainfall conditions. Although not rust resistant it gives better yields under epidemic conditions than Bencubbin and Nabawa. It is resistant to flag smut, yields flour which is usually superior in strength to that of the f.a.q. and is strong strawed.

Eureka.—Although this variety yielded well in several trials in 1947, average results over the past four years have been disappointing and it will probably be replaced by a variety such as Dowerin which is resistant to the new race of rust to which Eureka and its derivatives are susceptible. Eureka is a stout strawed, tall growing variety with translucent grain. Under slow ripening conditions the grain frequently mottles. The flour strength of Eureka is well above the f.a.q. of this State.

Early Maturing.

Dowerin.—This variety was selected at the Merredin Research Station from a cross between Sword and Kenya C6041 made in 1937 by E. C. B. Langfield.

It is unique in that it is the only variety released, which derives its rust resistance from Kenya C6041. It is resistant to all known races of stem rust in Australia. An early midseason maturing variety it is tall growing with fine straw and a tendency to weakness under certain conditions. The quality of the grain is in the upper range of the f.a.q. It has yielded well under trial, particularly in the higher rainfall areas. It is resistant to flag smut and powdery mildew.

Wongoondy.—This variety, which was selected at the Merredin Research Station from a cross between Eureka and Bungulla made in 1940, by E. C. B. Langfield is an early maturing variety which, under suitable conditions, produces grain approaching premium quality. Quality tests indicate an average Pelshenke time of 66 minutes, ranging in the average from 46 to 104 minutes and an average strength figure of 9.4 minutes as determined by the farinograph, an instrument used in the laboratory to ascertain baking quality, with a range of 6.3 to 14.4 according to soil and climatic conditions. It is a medium tall growing variety with a straw of excellent standing ability with a white, tapering, tip awned ear, which holds its grain well. It is highly resistant to race 34 stem rust, but not to the biotype of this rust race. This variety gives excellent promise and is favoured for its straw strength, earliness, prolificacy and its satisfactory grain quality. Yield data from five Research Stations and two farmers' trials indicates its good yielding capacity over a wide range of soil and climatic conditions, as compared with varieties which it is expected to replace.

Very Early Maturing.

Bungulla.—The standard early maturing variety which is a selection from Benubbin. Like Benubbin is notable for its high yields under low rainfall conditions. Because of its early maturity it usually suffers very little rust damage, but it is not resistant to rust. It is resistant to flag smut. The increased popularity of this variety over the past five years is an indication of its value in the Western Australian wheatbelt, especially in the lower rainfall areas where it has produced consistently under very unfavourable climatic conditions. It is used extensively for planting on ploughed up pasture land and was sown to 21.9 per cent. of the 1946 acreage sown to wheat for all purposes. Its main disadvantage is that it tends to be weak strawed, especially on light land and tends to lodge if sown before the third or fourth weeks of May.

Charter.—Released in 1944 by the New South Wales Department of Agriculture, and bred by Dr. S. L. Macindoe from a cross made at the Glen Innes Experimental Farm in 1931 between a selection of Kenya C6040, resembling C6042 in rust reaction, and Gular. Resistant to all Australian races of stem rust and to flag smut. The straw is tall and has a tendency to lodge.

Koorda.—A relatively recent release by the Western Australian Department of Agriculture, Koorda has yielded well on the lighter soils where its strong straw is of great value. Koorda is practically immune to flag smut and tends to be rust resistant in all but the heaviest epidemics. Flour strength of Koorda is about the same as that of the f.a.q. standard. It has gained popularity in this State during the past few years.

Farmers' Field Trials.

In addition to Wheat Variety Trials carried out on Research Stations various trials are also conducted on farmers' properties. The object of these Farmers' Field Trials is to test new varieties against the standard varieties under field conditions and thus to substantiate results obtained on the Research Stations. Results of the trials carried out in 1947 are summarised in Table No. IV.

TABLE IV.

1947 FARMERS' FIELD TRIALS—WHEAT VARIETY TRIALS.

Variety.	Yield.	Percentage of Control.	Average Percentage.*
K. WILLIAMS, Northampton.			
Early Maturity Trial.			
	Bus. lbs.		
Bencubbin	12 0	100	100
Charter	13 6	109	131 (2)
Bungulla	13 50	115	121 (2)
M77	14 48	129	130
Bencubbin	11 28	100	100
Wongoondy	11 46	103	118
Mid-Late Maturity Trial.			
Bencubbin	13 38	100	100
Eureka	14 50	109	131
Kondut	12 32	92	109
CARMODY & SONS, East Narrogin.			
Early Maturity Trial.			
Charter	14 47	84·5	...
Bungulla	16 18	100	...
Wongoondy	16 9	99	...
Mid-Late Maturity Trial.			
Bencubbin	13 22	100	...
Eureka	14 11	106	...
Kondut	15 13	112	...
E. A. METCALF, Wyalkatchem.			
Early Maturity Trial.			
Bungulla	23 33	100	...
Dowerin	24 21	103	...
Wongoondy	25 56	110	...

*Number of trials indicated in parenthesis.

ACKNOWLEDGMENTS.

This opportunity is taken of expressing thanks to the staff of the Research Stations for their assistance in conducting the above trials and also to the farmers whose co-operation made the Farmers' Field Trials a success.

REFERENCES.

W. P. Cass Smith and A. J. Millington (1944): Stem Rust of Wheat—*Jnl. of W.A. Dept. of Agric.*, Vol. XXI.

A. T. Pugsley (1946): Private Communication.

L. W. Samuel (1938): Flour Quality—*Jnl. of W.A. Dept. of Agric.*, Vol. XV.

L. W. Samuel (1945): The Influence of Some Crop Rotations and Fertilisers on the Strength of Wheat in W.A.—*Jnl. of W.A. Dept. of Agric.*, Vol. XXII.

I. A. Watson and W. L. Waterhouse: "A Third Factor for Resistance," "Nature," 17th February, 1945.

I. Thomas, L. W. Samuel and A. J. Millington: "Wheat Variety Trials on Research Stations"—*Jnl. of W.A. Dept. of Agric.*, Vol. XXIV.

FERTILISERS—ADDITIONAL REGISTRATIONS.

The following fertilisers have been registered at the Department of Agriculture under the Fertiliser Act, 1928, for the year commencing 1st November, 1947:—

Name of Fertiliser.	Reg. No.	Brand.	By whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works or on Rail Perth.
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust	Water Sol.	Citrate Sol.	Acid Sol.	Total.	Sulphate.	Murate.	
A.—MINERAL. 6. MISCELLANEOUS Seedling Manure .	71	Dawn	Dawn Nurseries	5 3				8 75	1·25	1 0	11·0	4·4	.	
Concentrated Garden Fertiliser ...	72	Anderson's Excellenta	Anderson & Co. .	.	4 1			9 3	Acid Cit. Sol. 1 4	Cit. Acid Insol. 0·8	11·5	4·0	.	
B.—ORGANIC. (a) Blood and Bone ..	73	Pannifex Fertiliser "G"	Burridge-Warren, Ltd.		.	6·25	.		7·25	Cit. Insol. 6·25	13·5	.	. .	

ERRATA.

Vol. XXIV. No. 4.—December, 1947.

Page 273.—Line 3 for "5 lbs. of powdered copper" *substitute* "5 ozs. of powdered copper."

Page 285—GRAPH—

Reverse legend so that "Butterfat production, 1946/47" appears *opposite* dotted line.

Page 361—FERTILISERS—

Last column, line 4—*For* "22.10.0 P" *substitute* "22.10.0 C.I.F. & E., Fremantle."

Last column, line 6—*For* "1.17.4 P" *substitute* "1.17.4 per cwt."

Last column, lines 7 and 8—*For* "18.0.0 W" *substitute* "18.10.0 W."

Column 6, line 8—*Delete* "30.00" and place *centrally* between columns 5 and 6.

Last line—*Delete* "manganese."

Page 362.—Column 14, above "5.75" *insert* "Manganese."

Column 9, line 13—*delete* "30.00" and *insert* "30.00" in column 13.

Page 363.—Last column line 9—for "13.3.4 W" *substitute* "13.13.4 W."

Column 6 line 11—*delete* "4.1" and *place centrally* between columns 5 and 6.

Column 13 line 11—*delete* "Potash" and "Potash Sulphate."

Column 5 line 15—*delete* "6.00" and *insert* "6.00" in column 7.

Column 5 line 16—*delete* "5.5" and *insert* "5.5" in column 7.

Column 5 line 17—*delete* "5.0" and *insert* "5.0" in column 7.

Column 7 line 21—*insert* "5.25."

Column 7 line 22—*insert* "6.0."

Column 5 line 25—*delete* "3.43" and *insert* "3.43" in column 8.

Columns 5 and 6—line 27—*delete* "2.00" and *insert* "2.00" in column 6.

Column 4 line 28—*for* "Kog Manufacturing Co." *substitute* "Kag Manufacturing Co."

Columns 5 and 6 last line—*delete* "5.00" and *insert* "5.00" in column 7.

By Authority: WILLIAM H. WYATT, Government Printer, Perth.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA

Vol. 25. (Second Series) JUNE, 1948 No.2

PASTURE COMPETITION.

ALBANY AGRICULTURAL AND HORTICULTURAL SOCIETY.
1947-48.

Judges: M CULLITY, Superintendent of Dairying—C. W. TOBIN, Dairy Instructor.

FOR the second year a Pasture Competition was conducted by the Albany Agricultural and Horticultural Society.

In the first year it was arranged that two sections should be included:—

(1) Pasture on high land,

(2) Pasture on flat land, (which would remain green through the summer months), with each entry limited to one acre.

In the recent competition, however, it was decided to have the entry cover the whole pasture on the property.

Two judgings were arranged; one between 26th November and 4th December, the second—designed to assess the amount of perennial species in the pasture on the 18th of February.

The value of these competitions is great and the Society, therefore, performed a very useful function in undertaking their organisation.

Competitors were extremely helpful in showing the pastures and describing their system of management.

Seasonal conditions for pasture in the district during the winter and spring of 1947 were better than for many years past. In some parts of the district deterioration in pastures had occurred in the two previous years, but the more favourable climatic conditions of this year appeared to be responsible for a remarkable general recovery, particularly with regard to the growth of subterranean clover. These conditions enabled farms and pastures to be presented in their prime at the first time of judging.

The second judging in mid-February, after a fairly long dry spell, presented pasture paddocks in an altogether different aspect and it was then management practices could be compared and fairly judged.

The points awarded to each entry are shown in the following table:—

Competitor.	Density and Evenness of Sward. *60	Absence Weeds and Insect Pests. 25	Botanical Composition. 40	Management. † 75	Total. 200
R. B. Wilkinson, King River	52	23	36	72	183
Farr Bros., Young's Siding	53	22	35	71	181
F. Pease, Torbay ...	53	22	36	67	178
J. F. Wilkinson, Kronkup	51	21	34	68	174
N. James, King River ...	52	21	33	66	172
L. Jordan, Napier ...	52	18	32	69	171
G. A. Smith, Redmond ...	54	22	35	60	171
A. Gale, Napier ...	54	20	32	64	170
W. Gibb, King River ...	52	21	34	61	168
H. Riggs, Napier ...	50	19	32	65	166

E. Poole, Lower Kalgan, withdrew from competition before second judging.
*According to age and soil type. †Including fencing and condition of fences and method of grazing.

R. B. Wilkinson.—Light jarrah-redgum country, including a bottle-brush flat, had been used to establish 175 acres of pasture. The area was sub-divided into 21 paddocks, well-planned and of convenient sizes. The condition of the pasture indicated good management. The species included mainly subterranean clover, with rye grasses being established, on the hill country; a fair area of kikuyu on the slopes and on the flat drooping flower, strawberry and lotus major clovers with paspalum grass, a little Yorkshire Fog and sweet vernal. Some silver grass and cape-weed present. The stocking comprised 20 milking cows and 27 head of other stock.

Fertiliser at the rate of 1 bag superphosphate per acre was applied, with an additional amount on summer land.

Farr Bros.—100 acres had been put down to pasture on jarrah-redgum country, and had been divided into 10 paddocks of varying sizes. An additional 50 acres of land on a nearby farm was used to accommodate the dry stock. The species comprised mainly dense subterranean clover with strong perennial and Wimmera rye grasses: some lotus minor, Yorkshire Fog, sweet vernal and the weaker grasses was present in the back paddocks, and the growth included dock and other weeds. An area of 5 acres had been put down to kikuyu grass combined with subterranean clover. On an area of new country, there was a good first year growth of subterranean clover which had been sown-on-the-burn.

The stocking comprised 33 cows with 27 head of other stock.

Fertilising had been carried out at the rate of 1 bag of superphosphate per acre, with heavier dressings on the hay paddocks.

F. Pease.—On good type jarrah-redgum country 70 acres of pasture had been established and sub-divided into 17 paddocks of varying sizes. Growth of subterranean clover and Wimmera rye grass was dense on the hay paddocks, with good growth of varying mixture and density elsewhere. Some paddocks contained drooping flowered clover, oats, a little lotus minor and kikuyu grass. The weeds seen comprised a little rush, sorrel and a few docks.

The stocking comprised of 24 cows plus 16 head of other stock, and was high. The fodder conservation programme and the growing of a fair area of maize planted in stages, is commended.

Fertilising was at the rate of 1 bag of superphosphate per acre.

J. F. Wilkinson.—40 acres of pasture had been established on low land of good loamy soil, subdivided into 8 paddocks. The species were mainly subterranean clover with Wimmera and Perennial rye grasses of fair density and uniformity, and some kikuyu and lotus major. A little silver grass and rush growth were to be seen.

This farmer's activities combined potato growing and sheep grazing and the stocking of the holding comprised 175 sheep.

Fertiliser used on this property was potato manure at the rate of 90-lbs per acre.

N. James.—This is a comparatively new farm with 60 acres of pasture established on light, stunted jarrah-sheoak country. The area had been subdivided into 7 paddocks. Clover and rye grass showed a good early growth on poor sandy soil, in response to the use of copper.

Stocking comprised 17 cows plus 13 other cattle.

L. Jordan.—The pasture area was 104 acres on jarrah-redgum country and was subdivided into 10 paddocks. This is a well farmed holding and is in fair order.

Stocking comprised 25 cows plus 15 other cattle.

G. A. Smith.—110 acres of pasture had been established on fairly heavy jarrah-redgum country and divided into 13 paddocks on fairly heavy jarrah-redgum country. There was a good showing in the spring but the paddocks were fairly bare on the second judging. A nice area of kikuyu has been established.

Stocking comprised 23 cows and 42 other cattle.

A. Gale.—The pasture area of 30 acres on jarrah-redgum country had been divided into 6 paddocks. There was a good showing of subterranean clover in the spring.

Stocking comprised 8 cows plus 12 other cattle.

W. Gibb.—40 acres of pasture sown on very light sandy soil and divided into 9 paddocks.

Stocking comprised 4 cows plus 4 other cattle and 50 sheep.

H. Riggs.—60 acres of pasture established on jarrah-redgum country, showed general deterioration, possibly due to insufficient superphosphate dressings in previous years.

Stocking comprised 23 head of dry cattle.

MILL OFFAL FOR RABBIT POISONING.

A. S. WILD, Chief Inspector, Vermin Branch.

THE most common and perhaps the most expedient method of rabbit destruction is that of distributing baits prepared from bran and pollard and poisoned with phosphorus mixture. The comparative ease of preparation and also distribution through poison carts, the area of land which can be treated at a convenient time of the year, and the fact that paddocks may be used for stock a reasonable time after treatment, all render this method especially attractive to those responsible for the destruction of rabbits. The present shortage of both bran and pollard is therefore unfortunate now that rabbits are showing decided increases in numbers, and, where these materials are unprocurable, it is necessary to use substitutes. These substitutes are marketed as branato and polato, the former being the coarse material from crushed wheat and the latter, the fine material. The cost of these is approximately 10d. per bushel above that of bran and pollard.

The use of these unfamiliar substances would present a difficulty to those accustomed to the mixing of bran and pollard. Generally the approximate proportion of three or four of pollard to one of bran makes a bait, which is easy to distribute through most types of poison carts, and also has a degree of friability necessary for its disintegration about a week or 10 days after distribution. However, rough tests by the Vermin Branch of the Department of Agriculture have indicated that proportion of branato to polato in mixtures needs to vary much more widely than that of bran and pollard. When the proportion of polato to branato exceeded that of equal portions a very sticky mixture was produced, and, under field conditions, baits tended to seal up. This condition would tend to maintain unconsumed baits in a condition dangerous to stock. It is evident that the greater proportion of a mixture must consist of branato rather than polato, and, for the smaller types of distributors, two of branato could probably be used to one of polato. For the larger type of poison cart probably three of branato to two of polato would be most suitable. Such a mixture should be of the right consistency for distribution and at the same time be sufficiently friable for disintegration within a reasonable period of time, so that, subsequently, stock could be placed in the paddock without danger of poisoning from unconsumed baits.

MEADOW HAY COMPETITION, 1947-1948.

ALBANY AGRICULTURAL & HORTICULTURAL SOCIETY.

Judges: M. CULLITY, Superintendent of Dairying & C. W. TOBIN, Dairy Instructor.

THE Australian Dairy Produce Board, Pasture Improvement Committee, West Australia, has sponsored and donated prizes for numerous pasture and meadow hay competitions in the dairying districts in recent years. It has been particularly interested in the south coastal districts and arranged to co-operate with the Albany Agricultural and Horticultural Society in conducting this competition.

The basis of adjudication was laid down in the following scale of points:—

	Points.
Mixture—Botanical Composition	20
Type and Palatability	30
Time of cutting	25
Aroma	10
Amount conserved per cow	15
Total	100

Minimum quantity: 10 tons.

Judging to be conducted after stacking or baling, (early, February).

This scale was designed to enable each competitor to assess from the results the good and bad features of his entry, and also to encourage each to study the characteristics of good hay and the value of the conservation of sufficient quantities. To assist in achieving this result, the following explanation of the method of judging is given:—

1.—*Botanical Composition.*

Maximum points would have been given to a mixture of clovers and grasses of good quality. For example—a mixture of 60% subterranean clover and 40% perennial rye-grass, Cocksfoot or Phalaris tuberosa, would get full points.

The presence of weeds, relatively innutritious grasses such as spear grass, would result in a reduction of points. Too little grass of good quality or too little clover, would cause a similar reduction in rating.

2.—*Type and palatability.*

It is, of course, impossible to assess palatability directly but the following characteristics are taken as indicating attractiveness:—

(a) *Colour.*—The greatest number of points are given to those samples with the greenest colour, as the retention of natural greenness is taken as an indication of the hay having been protected in curing and therefore having retained the natural high nutrient content in respect of protein, and vitamin, as well as palatability.

(b) *Leaf.* -The retention of the leaves is proof also of care in making, but more important, the leaves are the most valuable section of the plant, measured as sources of protein and vitamins.

(c) *Condition.*—The hay should be dry enough to avoid heating in the stack, but sufficient moisture to allow handling without the loss of leaf is necessary.

3.—*Time of cutting.*

In deciding the stage at which hay should be cut, the farmer has to achieve a nice balance between food quality and yield. There is no question that if hay were cut earlier than the conventional stage the actual value in feeding, particularly as a source of protein, would be greater. This, however, could be achieved only at the sacrifice of considerable weight. In cereals, hay is cut after flowering, but before the grain is hardening. Variations in the stage of cutting occur in oats and wheat. The former is cut later in order to avoid bitterness, which occurs in some varieties.

With subterranean clover, it is usual to cut when the top flowers are forming. At this stage most of the annual grasses will be in seed, while seed is forming in perennial rye-grass.

In this section, therefore, an examination is made to determine as closely as possible, whether the crop has been cut at the right stage. More points are lost for late than for early cutting. The latter rarely occurs.

4.—*Aroma.*

This is self-explanatory. The aroma must be clean, sweet and bright, suggesting extreme palatability. The presence of mustiness is a defect.

5.—*Amount per cow.*

An amount of 2½ tons of hay, or its equivalent as silage or green crop, per cow was adopted as the basis for maximum points. This quantity is that needed to fully feed a herd from the end of hay-cutting till there is ample pasture feed at the end of the following July.

Where silage or green crops were available the equivalent as hay was calculated and added to the estimate of the quantity of hay available.

The points allotted to the entries are shown in the following table:-

Competitor.	Botanical Mixture. 20	Type and Palatability. 30	Time of Cutting. 25	Aroma. 10	Amount per Cow. 15	Total. 100
R. B. Wilkinson, King River	18	24	22	8	9	81
F. Pease, Torbay ...	18	22	24	7	9	80
Farr Bros.. Young's Siding	17	21	23	8	5	74
W. Gibb, King River ...	17	19	18	7	12	73
H. Riggs, Napier ...	14	17	18	5	15	69
L. Jordan, Napier ...	16	18	18	6	9	67
N. James, King River ...	15	17	20	5	4	61

Comments on each entry are as follow:—

R. B. Wilkinson.—The hay was of fairly good colour and aroma. There was ample clover mixed with some rye-grass, sweet vernal and paspalum.

The quantity conserved was not sufficient for adequately feeding the herd through a dry summer, but the presence of green pasture paddocks on this property is a safeguard.

F. Pease.—More than one stack was inspected. One, however, was a carry-over from the previous year and had suffered through weathering, otherwise this entry would have scored higher points. The general character and condition of the new stacks were good.

The quantity conserved was supplemented by a stack of silage and several acres of green crop.

Farr Bros.—An excellent mixture of subterranean clover and rye-grass had been cured. Colour was good, but the aroma was sweetish and musty. The material had been cut a little late and had suffered slightly from rain damage.

The quantity conserved was lower in proportion than for the two leading entrants.

W. Gibb.—The hay was variable: Some was pure-clover with other sections almost solely grass. The species included, however, were mostly of attractive types, but unfortunately cut late and allowed to become brittle. Leaf loss on a portion was high.

There was a greater reserve of hay in proportion to the stock to be fed, on this property than on those of the leading competitors.

H. Riggs.—This was the only competitor with baled hay. The mixture, however, was not quite as attractive as the other competitors inasmuch as a greater proportion of poor grass was included. Consequently points were lost for type and palatability, as well as for mixture.

This entrant, however, had a greater supply of stored fodder in proportion to his stock than the others. The value of baling was well demonstrated.

L. Jordan.—Both silage and hay were stored. The hay was made from oats, subterranean clover, rye-grass plus a proportion of spear and soft brome grasses. The hay was a little too dry and lost points on that account. Allowance was made for quantity because of the stock of approximately 30 tons of silage. The value of this succulent feed was apparent in its palatability for the cows and in their sleek appearance.

N. James.—A good variety of species was included in this hay, but too little clover was present to enable high points to be allotted. Oats, subterranean clover, soft brome grass, Lotus sp. and other species were included. The aroma was fair only, while the hay generally was dry and dusty. It appeared that through force of circumstances the gathering and stacking of the crop had been unduly delayed.

GRADING STANDARDS FOR EXPORT LAMBS

F. L. SHIER, Export Lamb Adviser.

IN pre-war days fat lambs were exported from Australia under four quality grades, namely "Downs," Firsts or Blues, Seconds or Reds, and Thirds or Whites, with a number of sub-grades or weight ranges. In the war period and under the Imperial Government Purchase plan with the Commonwealth Government the down grade was eliminated, owing to the small numbers involved. Shipping space had to be conserved and the overall work of transportation and distribution reduced to a minimum. Down grade lambs which normally sold at a premium of about ½d. lb. above the ordinary first grade were not graded out separately but were bulked together with the ordinary first grade.

Fullness and depth of meat (muscle) over the carcase with the correct covering of fat including selvage fat (outside), generally referred to as "finish", determines whether a lamb is graded first grade. Shape and conformation are not taken into account to the same extent as required for the down grade. To qualify for the down grade, lambs, in addition to being first grade, must be of down conformation; that is the carcases short and nuggety and exhibiting the conformation and characteristics of the down breeds. Such carcases give the high quality and priced thick short joints.

Farmers who were breeding the down type lamb felt that they were being penalised by the omission of the grade and were not receiving full value for their high quality lambs. This was freely admitted by those in control but under the circumstances then prevailing the elimination of the down grade was the only logical thing to do. However, once hostilities ceased and transportation and distribution difficulties eased, everyone associated with the industry agreed that this grade should be reintroduced. It is quite true that the omission of this grade penalised the producer of the top grade lamb of the type recommended for and desired by the London market. In time this policy could only react unfavourably on general quality and type of lamb produced in Australia for export.

In consequence therefore the down grade was reintroduced into the export lamb schedules in 1946. However gradings of lambs during 1946 and 1947 at the export works throughout Australia indicated that grading standards were not uniform. In some instances the number of "downs" being graded out of good, well bred, lines of lambs was so small as to indicate that the standard adopted by some graders was far too high and impossible to reach with any reasonable numbers by even the best breeders. Most producers are familiar with the ideal lamb, which wins at leading Agricultural shows, but it is necessary to be realistic. It would be absurd to make this ideal show carcase the standard.

The standard of the down grade should be such that reasonable numbers can be exported so that the grade and label can become widely known to the trade and housewife in England. Further, so as to act as an incentive to producers this down grade should be possible to attain with a reasonable percentage of the first grade lambs by those farmers who are adopting good recommended methods of breeding and feeding. Where the percentage of "downs" from a consignment which grades over 90 per cent. first grade, bred from crossbred ewes and Southdown sires, is only one or two per cent. then there is little inducement to continue along these lines, when other breeds may give practically the same grading but heavier weights in the same time.

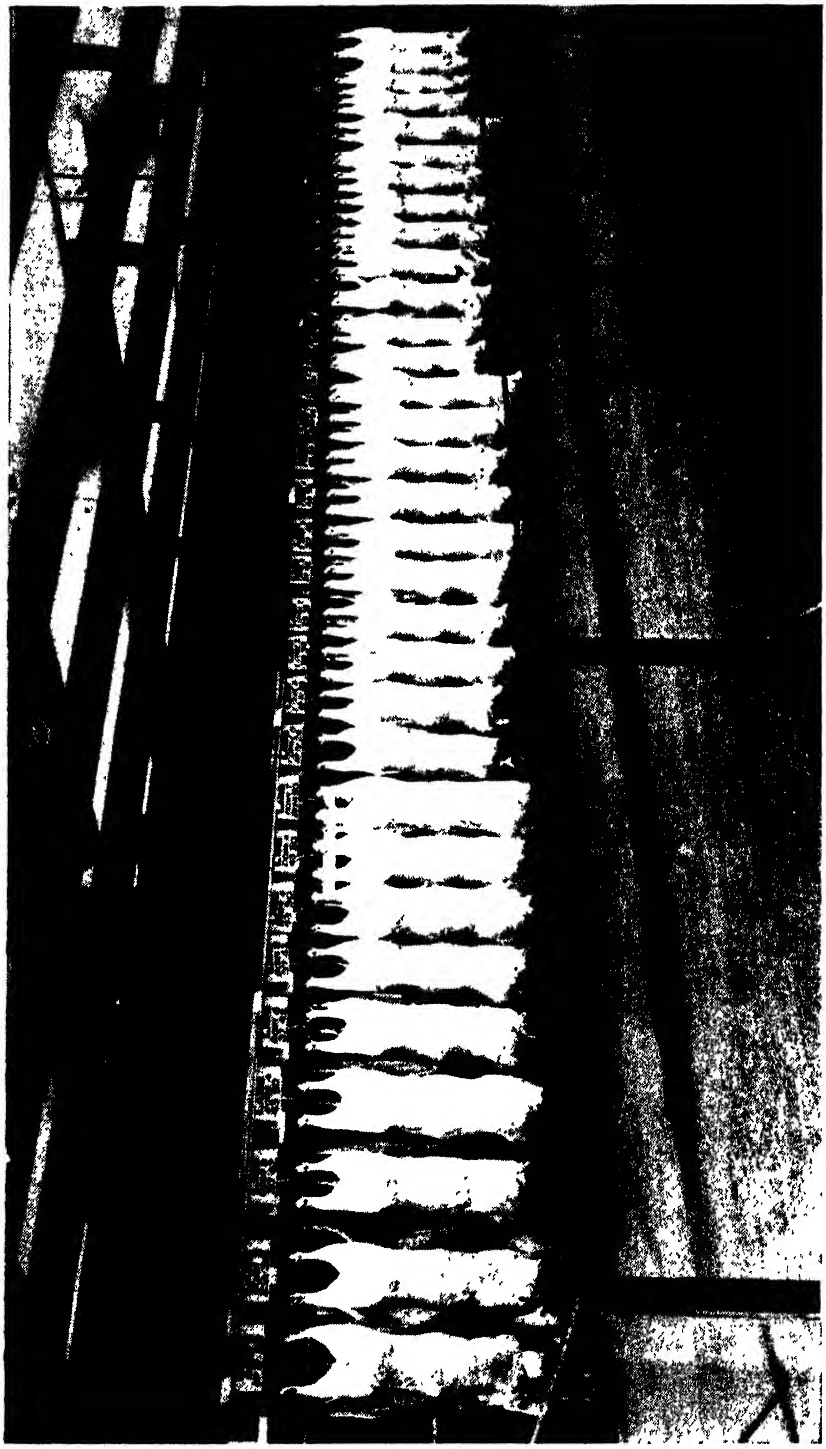


Illustration 1.

A general view of the display of lamb carcases. The down grades are on the left followed by the ordinary firsts, then seconds and finally thirds at the far right. Mutton carcases are on the line behind the lamb carcases.

Quite naturally these matters have therefore been subject to comment by all those interested in maintaining Australia's good name on the British market, including many in this State, who considered that good producers were being penalised and further that permanent harm would be done to the industry if the position was not rectified in a realistic manner.

The Australian Meat Board took the matter up last October with officers of the Commonwealth Department of Commerce and Agriculture. The latter body actually controls grading standards at the export works throughout Australia. After due consideration and investigation it was considered that the standards for both lamb and mutton in operation in Victoria (at the end of 1947) were reasonable and in the case of the down grade could be reached by producers working along sound and recommended lines.

These two bodies working in conjunction made arrangements for a conference of interested persons in Melbourne on February 16th, 1948, at which the whole question of uniform lamb and mutton grades could be discussed. A display was staged of a full range of carcases of quality grades and weight ranges then in operation in Victoria. Officers of the Department of Commerce and Agriculture demonstrated the points, qualities, and defects of the various carcases and the reasons for their being placed in the particular grades.

After a very complete discussion it was unanimously decided by the meeting, firstly that the Victorian standards as displayed should be adopted throughout Australia, and secondly that the Department of Commerce should appoint a number of standardising graders to keep grading standards uniform at all export works.

The Australian Meat Board is to be congratulated in taking the initiative in this matter, and the Chairman, Mr. J. L. Shute, for the manner in which he handled the meeting which finally came to a unanimous decision on a very contentious subject.

With the introduction of the grading standards agreed to at this Conference, West Australian producers of the down type lamb can reasonably expect an improved percentage of "Down" grade from their consignments this year.

In the accompanying illustrations, by courtesy of the Australian Meat Board, readers will obtain an appreciation of the completeness of the display and some idea of work and effort put in by officers of the Department of Commerce and Agriculture in its preparation.

It should be borne in mind that in any grade there is always a range. Some carcases are at the top of the grade and others just "scrape" in at the bottom. This display was built up from carcases available at the export works concerned towards the end of the Victorian season, and in consequence the ideal carcase for any grade or weight range could not be obtained in all instances. The illustrations do not show the range in any particular grade but do illustrate the major differences between the various grades.

As a matter of interest to producers a schedule is included hereunder giving the several quality grades and weight ranges for export lambs.

Quality Grades.	Weight Ranges lbs				
	D's.	2's.	3's.	4's	T's.
Downs	20–28	29–36	37–42	43–50	...
Firsts (Blue) ...	20–28	29–36	37–42	43–50	51–56
Seconds (Red) ...	20–28	29–36	37–42	43–50	...
Thirds (White) ...	L's 20–28		O's 29–50		...

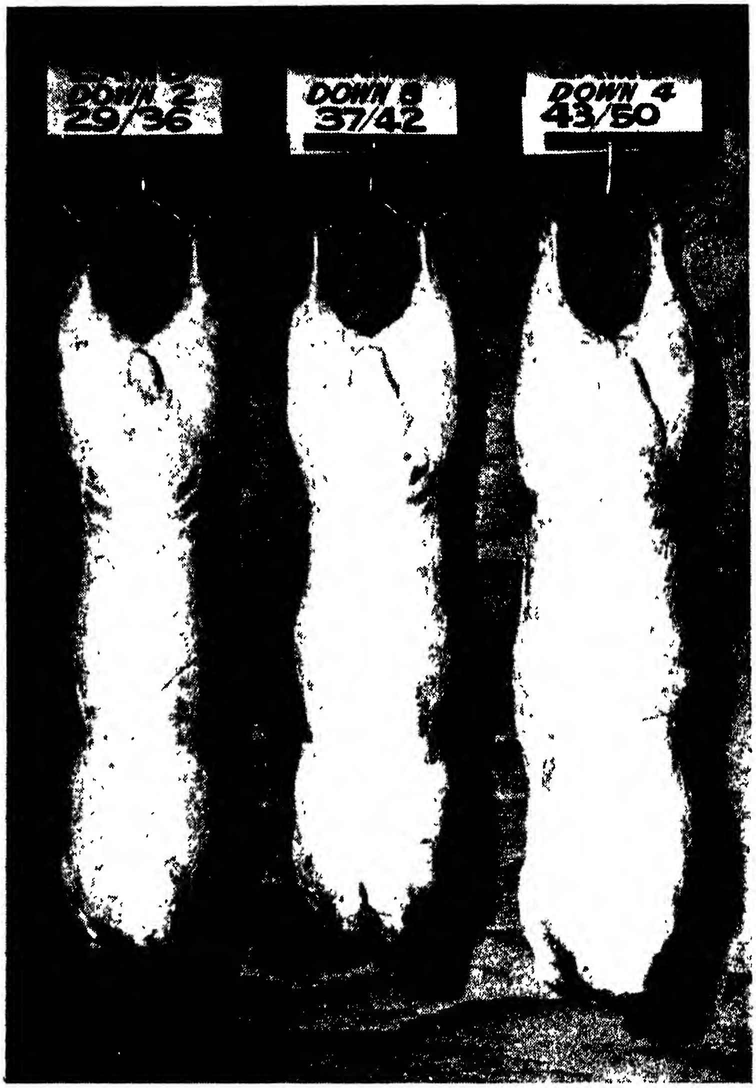


Illustration 2—Down Carcases.

Down carcases of the three main weight ranges (2's 8's and 4's.) Note the short "down" conformation, short well filled legs, well filled loins and shoulders, short neck and good covering of selvage fat.

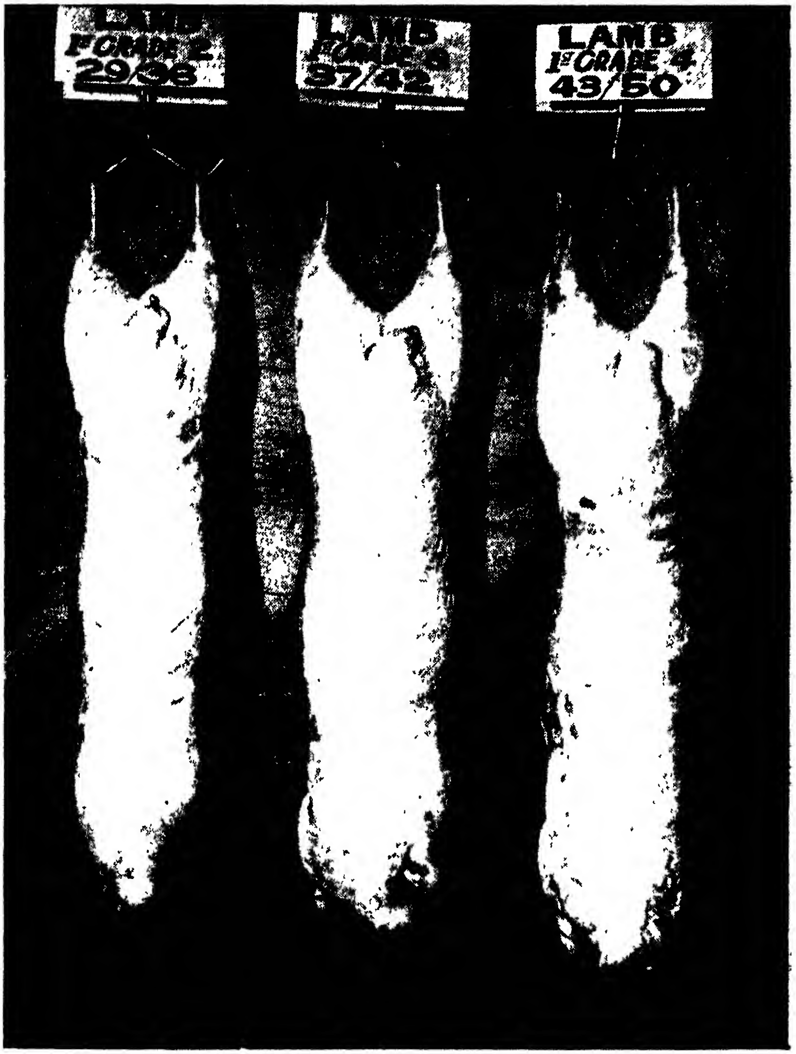


Illustration 3—Ordinary First Grade Carcases.

Compare with illustration 2. Note the good loins and shoulders, selvage covering and general "finish" *but* the longer carcase, legs and neck. These carcases would not cut into similar chubby joints as would the "downs."

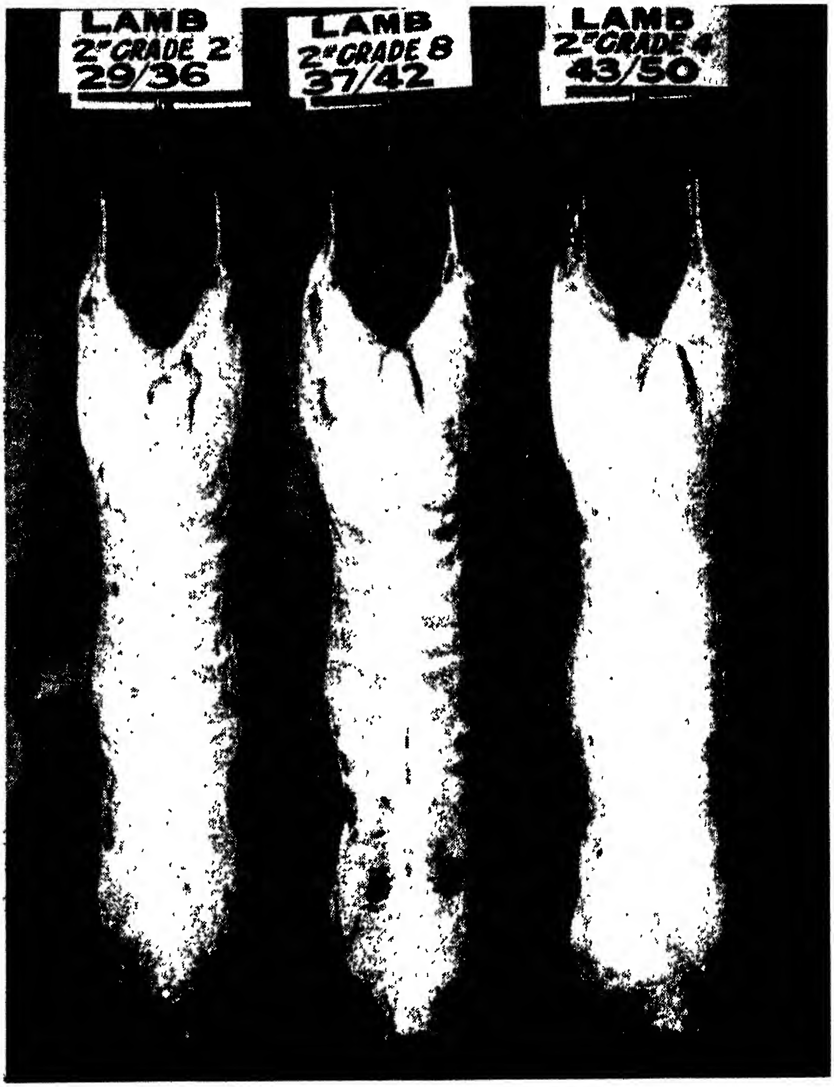


Illustration 4—Second Grade Carcases.

Compare with illustration 3. These carcases are not as well finished as the "firsts," showing poorer loins and legs and lighter fat covering over legs, loins and shoulders. Compare the length of leg in these carcases against those in illustrations 3 and 2.

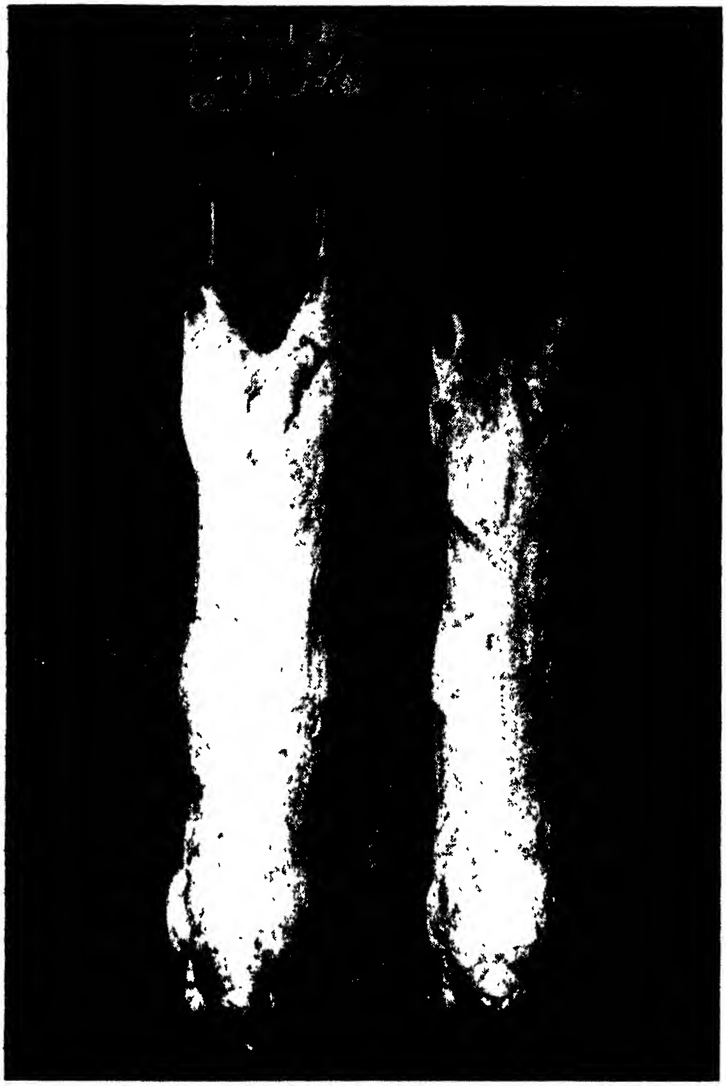


Illustration 5—Third Grade Carcases.

Note the excessive leg length, the obvious high proportion of bone to meat, poor depth (small eye) of meat on the loins and light covering of selvage fat. The carcases indicate that the lambs suffered from under nutrition. The skeleton has continued to grow and develop but the feed available has not been sufficient for the lambs to lay down flesh and fat at the same time, resulting in poorly fleshed and "unfinished" carcases.

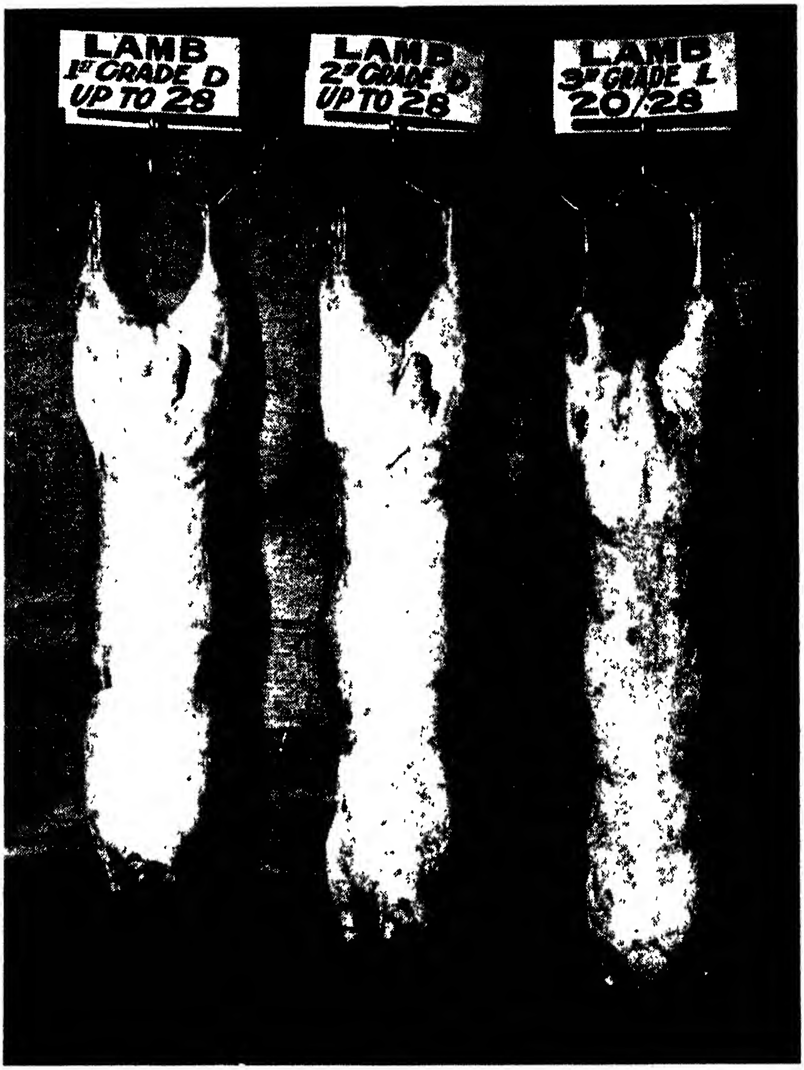


Illustration 6—A First, Second and Third Grade Carcase of the "D" Weight Range (20-28 lbs.).

Whilst these lambs are of a similar weight note the gradually increasing length of the carcases and length of leg; the decreasing depth of meat, fullness of the loin and covering of selvage fat; and the narrowing across the shoulder. The proportion of bone to meat gradually increases over the three carcases and is obviously very high in the 3rd grade.

LARYNGO-TRACHEITIS.

C. R. TOOP, Acting Chief Veterinary Officer,
Department of Agriculture.

INFECTIOUS Laryngo-tracheitis, one of the respiratory group of diseases of fowls, was diagnosed for the first time in Western Australia a few months ago. A survey has since shown that it is already widely distributed and occurs in various parts of the State.

The available evidence indicates that this is not a new disease in Western Australia but that it has existed in the State for a number of years and the fact that its identity has now been definitely established need not therefore occasion undue alarm.

It has been the history in all countries where laryngo-tracheitis occurs that the disease has become endemic before it has been diagnosed and Western Australia has proved no exception in this regard.

The infective agent is a virus which attacks the respiratory tract of the fowl in which it sets up inflammatory changes. The infection is believed to be spread by inhalation. The symptoms of the disease are extremely variable ranging from an acute type in which there is evidence of respiratory distress and gasping together with coughing and the expulsion of mucus and blood, to a chronic form characterised by the formation of cheesy deposits in the eyes, nasal passages, palate and larynx. Sometimes the disease occurs in so mild a form as to escape recognition.

The mortality resulting from the disease is also very variable. When it occurs in a mild form the losses may be negligible, but in severe outbreaks they may exceed 50 per cent. Mortalities of 10-15 per cent, are however more usual. To this must be added the losses resulting from depressed egg production.

Birds which have recovered from an attack of laryngo-tracheitis develop an immunity against the disease and do not again become affected. These apparently healthy recovered birds, however, may continue to harbour the virus in their respiratory tracts remaining carriers of infection which they spread to susceptible birds with which they come in contact. Thus, when the disease first makes its appearance in a hitherto clean flock, the outbreak can almost invariably be traced to the introduction of carriers from an affected property. Moreover, it is these carriers which perpetuate the disease in a flock. They spread the infection to each succeeding batch of pullets with which they come in contact and are responsible for the recurrent annual outbreaks which take place on affected properties.

When a flock is free of laryngo-tracheitis it can usually be maintained in that condition provided new introductions are confined to day-old chicks from which the risk of infection is negligible. The introduction of all other fowls including started chicks, which may be carriers of infection, must however be avoided. Once the disease has become established on a property, vaccination provides the only practical means of control.

CAUSE.

The disease is caused by a filterable virus which enters the body by way of the respiratory tract where it becomes established and remains. The infection is believed to be spread by the inhalation of fine particles of mucus containing the

virus which are expelled by diseased birds when coughing. The virus is extremely fragile and does not survive for more than a few hours apart from the fowl.

Factors such as faulty management and feeding, over-crowding, green feed (Vitamin A) deficiency and heavy worm infestation which lower the resistance of the birds and increase their susceptibility to infection predispose to the disease and, under such adverse conditions, heavy mortality may occur.

Fowls of all ages may become affected by the disease but pheasants are the only other species known to be susceptible.

White Leghorns suffering from acute Laryngo Tracheitis.

SYMPTOMS.

The symptoms exhibited by affected birds vary according to the severity of the attack. In the acute form of the disease there are symptoms of gasping and difficult respiration; the neck is extended during inspiration, the mouth is opened widely and gurgling or rattling sounds due to the presence of a copious secretion of mucus in the trachea (windpipe) may be heard. In some cases a frothy mucous discharge may be present in the eyes and nostrils. Affected birds cough frequently and shake their heads vigorously and this may be accompanied by the expulsion of mucus, which sometimes contains blood, and is usually followed by swallowing movements. The beak is wiped frequently on the feathers of the back which, in consequence, becomes dirty and matted in appearance. Birds affected by the acute form of the disease may die within 24 hours of the onset of symptoms.

The chronic form of the disease is characterised by the formation of yellow caseous (cheesy) deposits in the eyes, infra-orbital sinuses, palate, nasal passages and larynx. This may result in "bunging up" of the eyes and blindness or in the development of large swellings beneath the eyes due to the distension of the sinuses with this cheesy material. When the larynx becomes involved, respiration becomes difficult and may be accompanied by wheezing and whistling. In many cases the larynx becomes completely blocked by a plug of cheesy material and death results from suffocation. Affected birds lose condition rapidly becoming ruffled and dejected in appearance and there is a foul odour from the mouth and nostrils.

POST-MORTEM APPEARANCES.

In carrying out a post mortem examination, the larynx and trachea (windpipe) should be opened with scissors, care being taken to prevent the entrance of blood into its cavity from the surrounding tissues.

In the acute form of the disease the larynx and trachea will be found to contain an abundant mucous secretion and the lining membranes may be swollen and acutely inflamed. In some cases there is haemorrhage into the trachea when free blood or blood stained mucus will be found in its cavity. The mucus secretion, at first fluid, later solidifies being replaced by a yellowish cheesy exudate which sometimes takes the form of a tube-like cast lining the whole or portion of the trachea.

In the chronic form of the disease involvement of the trachea is unusual, the lesions being confined to the eyes and associated structures, palate, nasal passages and larynx any or all of which may be found to contain a yellow caseous (cheesy) exudate. The formation of these cheesy deposits is always preceded by the presence of a fluid mucous discharge.

The changes which occur in laryngo-tracheitis are confined to the respiratory tract; no abnormalities being observed in other tissues or organs.

DIAGNOSIS.

Since laryngo-tracheitis, particularly in the less acute and chronic forms, may be readily confused with certain other of the respiratory group of diseases affecting fowls, diagnosis frequently presents a difficult problem and it is only when the disease occurs in the peracute form accompanied by high mortality, symptoms of severe respiratory distress and haemorrhage into the trachea that a positive diagnosis can be justified on clinical grounds. The presence of blood or bloody mucus in the trachea is diagnostic of laryngo-tracheitis and does not occur in any of the other respiratory diseases of the fowl.

In the absence of haemorrhage, however, the disease may be confused with Coryza and in order to differentiate the two conditions and establish a definite diagnosis it is necessary to resort to laboratory methods involving transmission experiments, immunity tests and the bacteriological examination of discharges from affected birds.

It should, however, be recognised that whereas recovery from an attack of laryngo-tracheitis confers a life-long immunity no such immunity results from an attack of Coryza and recurrent outbreaks of this disease may continue to occur amongst birds of all ages on the property. In contrast in a flock affected by laryngo-tracheitis the annual outbreaks which occur are confined to the young stock on the property; the older birds which have become immune through previous exposure remaining healthy.

Other diseases occurring in Western Australia which might possibly be confused with laryngo-tracheitis, include fowl pox and Vitamin A (green feed) deficiency. Mortality from fowl pox, however, is usually very low and in addition to the cheesy deposits that may develop in the eyes and mouth, wart-like eruptions are usually present on the comb and wattles.

In the case of green feed deficiency besides the lesions in the eyes and mouth, pustules will be observed in the gullet often extending down to the crop. Moreover, a rapid recovery will occur when the Vitamin A deficiency is corrected by feeding adequate amounts of good quality green stuff or by the addition of a Vitamin A rich supplement such as shark liver oil or some similar preparation to the ration.

Poultry farmers who suspect the existence of laryngo-tracheitis in their flocks are requested to forward specimen birds to this Department for examination. Recovered birds which have survived an outbreak of the disease are best for this purpose, since they contain neutralising anti-bodies in their blood which may be subjected to immunity tests enabling a positive diagnosis to be made. In cases where an outbreak of disease is actually in progress, arrangements will be made for an investigation to be conducted on the property.

IMMUNITY—CARRIERS.

Recovery from laryngo-tracheitis results in the development of a life-long immunity so that birds that have survived an outbreak of the disease do not again become affected. Recovered birds may, however, continue to harbour the virus in some part of their respiratory tract, remaining carriers of infection and spreading the disease to susceptible birds with which they come in contact. It is these apparently healthy carriers which are responsible for the recurrent annual outbreaks, which take place on affected properties, since they transmit the disease to the susceptible young stock when contact occurs after they have been transferred from the rearing pens. Thus, when laryngo-tracheitis first makes its appearance in a flock, birds of all ages become affected, but in subsequent outbreaks the disease is confined to the young stock on the property, the older birds, although spreading the disease, remaining healthy.

Similarly, when an outbreak occurs in a hitherto clean flock, this can almost invariably be traced to the introduction of carriers from an outside source.

White Leghorn showing signs of acute Laryngo Tracteitis.

HOW TO PREVENT THE INTRODUCTION OF THE DISEASE.

A flock which is free of laryngo-tracheitis can usually be maintained in that condition indefinitely provided carriers are not introduced on to the property. This may be assured by restricting new introductions to day-old chicks from which the risk of infection is negligible. The introduction of any other fowls on to the property must at all costs be avoided, and this will apply not only in the case of adult birds intended for breeding purposes or egg production, but also to started chicks.

Apart from the introduction of carriers, the disease is only likely to be introduced into a clean flock through close proximity to an affected neighbouring property. Since the virus does not survive for more than a few hours, apart from the fowl the introduction of infection through the agency of crates or coops that have been in contact with diseased birds appears to be remote.

The disease is not transmitted through the egg, so that eggs intended for incubation may be purchased with perfect safety.

CONTROL OF THE DISEASE—VACCINATION.

On properties where the disease is known to exist, vaccination provides the only practical means of control. This consists in lightly scarifying the cloaca or vent with an applicator designed for the purpose, and, at the same time, applying a small amount of the laryngo-tracheitis virus to the scarified area.

Successful vaccination results in the development of a local inflammatory reaction or "take" which stimulates the formation of antibodies in the blood and tissues of the treated bird, thus enabling it to resist the disease. This immunity develops after an interval of 7-10 days and will protect the bird from infection during the remainder of its life.

Pullets and other young stock should be vaccinated after reaching the age of 10-12 weeks. Following vaccination a small proportion of the birds may actually develop the disease and thereafter become carriers. The indiscriminate vaccination of clean flocks would consequently result in the further dissemination of the disease and cannot be permitted.

Vaccination must for the present be confined to properties or localities in which the disease is actually known to occur. Further particulars regarding vaccination may be obtained upon application to this Department.

When the disease occurs in a small flock, upon which the owner is not dependent for a livelihood, its eradication by the slaughter of all fowls on the property followed by restocking with day-old chicks should, in most cases, provide the best means of control. The adult birds could be disposed of at a favourable opportunity and restocking with day-old chicks would ensure against the reintroduction of infection.

QUARANTINE AREA.

In order to prevent the further spread of the disease to country districts, a quarantine area embracing the metropolitan area and including the Municipalities of Perth, Fremantle, East Fremantle, North Fremantle, Cottesloe, Claremont, Subiaco, Guildford and Midland Junction, and the Road Districts of Fremantle, Buckland Hill, Peppermint Grove, Nedlands, Perth, Bayswater, Belmont Park, Bassendean, Canning, Gosnells, South Perth, Melville, Armadale-Kelmscott, Darling Range, Mundaring and Swan has been declared.

No fowls other than day-old chicks and started chicks not exceeding the age of eight weeks produced on hatcheries upon which no adult fowls are kept, will be permitted to be removed from this quarantine area to the country districts.

THE LUCERNE FLEA.

(*SMINTHURUS VIRIDIS* L.)

By

C. F. H. JENKINS, Government Entomologist.

P. N. FORTE, Assistant Entomologist.

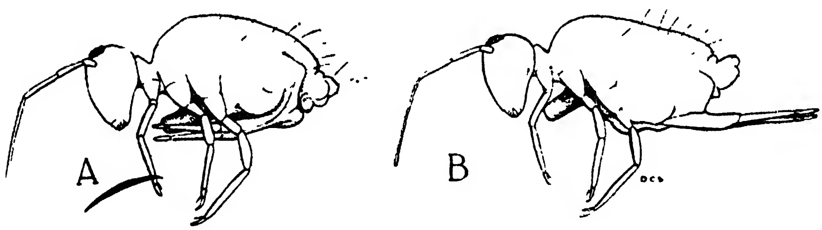
THE lucerne flea or clover springtail is best known in this State as a pest of clover pastures, but various plants, including many types of vegetables, are also liable to attack.

The insect is of European origin, being widely distributed over that continent. It occurs also on the north coast of Africa, in the Argentine, and in all the Australian States with the exception of Queensland.

The date of its introduction into Australia is not known, but it was noted in South Australia as early as 1884. It was not until 1910 that the pest was observed in Western Australia, and it is believed that baled fodder imported from South Australia was the medium of introduction.

GENERAL DESCRIPTION.

The terms flea and springtail imply that the insect is a good jumper, and this is very true, but the creature is not by any means closely related to the true flea. It does not jump by means of well developed legs, as does the flea, but with the aid of a special organ known as the spring. Reference to the accompanying illustration will show just how this mechanism works.



Sketches showing the mechanism of the spring. (A) Spring folded under body in the normal position. (B) Spring extended after jumping. The structure projecting from between the middle pair of legs is the base of the ventral tube (adhesive organ). Only the appendages on the near side are shown.

(After Swan.)

The insect is a dumpy-looking creature, wingless and about 1/10th of an inch in length. The colour pattern varies greatly but green or greenish yellow usually predominates. The mouth parts are of the biting type and the plant material is actually chewed and swallowed.

LIFE HISTORY.

The eggs are laid in batches in moist situations either on the soil surface or beneath decaying leaves and debris. After being laid the eggs are covered by the female with a fluid consisting largely of excreted soil, and on drying, this coating renders the eggs very difficult to detect.

In captivity the female has been noted to lay about 60 eggs to a batch and two batches appear to be the average. Under favourable conditions the eggs hatch after three or four days and a "nymph" emerges, resembling its parents in general appearance, but much smaller. The time required for the nymph to develop fully will vary greatly with weather conditions, but is about a month under normal circumstances. As the active period of this pest is approximately from May to October, it is evident that a number of generations can develop during the season.

When warm, dry conditions arise the eggs fail to develop. They successfully withstand the heat and desiccation of the summer until the next autumn rains again bring about conditions favourable for hatching to take place.

HABITS.

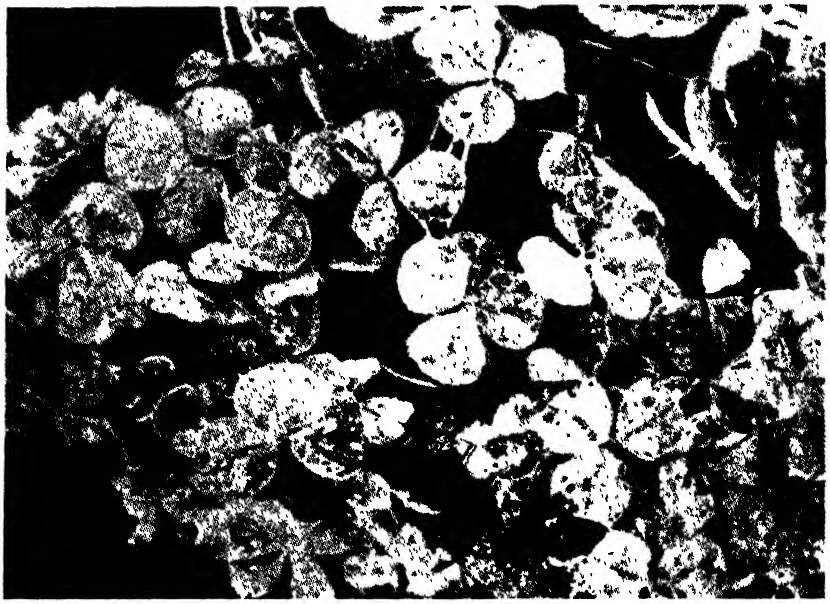
The lucerne flea, like the red-legged earth mite, is very dependent upon moisture and quickly succumbs should hot, dry conditions prevail for any length of time. It is seldom a serious pest in sandy localities, but thrives on heavy and slightly acid soils. The reason for this is probably associated with the insect's habit of eating quantities of soil during its life.

The injury caused by the lucerne flea is quite characteristic; small irregular portions of the leaf may be eaten right away, leaving a ragged hole, or the lower surface of the leaf may be left intact as a whitish film.

Dorsal view of Lucerne flea.
(After Swan.)

Lucerne flea injury is sometimes confused with that caused by the red-legged earth mite, for both pests favour much the same environment and have a preference for seedlings and low-growing, wide-leaved plants, but a careful inspection will soon reveal characteristic differences in the injury caused by each.

The mite is a sap sucker, and so does not actually remove any of the solid plant tissue. No jagged holes will be seen in leaves attacked by the mite and leaves bleached by the lucerne flea will be almost transparent when held up to the light. The mite-injured leaves, although bleached, still remain opaque.



Clover damaged by lucerne flea.
(After Dumbleton.)

Although clovers and lucerne are the favourite food plants of the lucerne flea, capeweed is also a very important host plant and often shows severe injury. Vegetables, such as peas, beans and potatoes, grown in close proximity to weedy land supporting a growth of capeweed may be seriously affected.

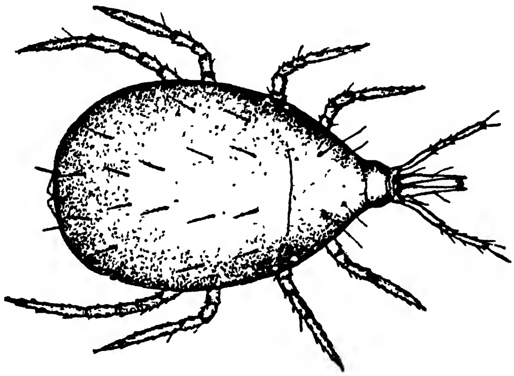
CONTROL.

Cultural Methods.—The advantage of clean cultivation in the establishment of clover or lucerne will be obvious, bearing in mind the wide host range of the pest, and its liking for capeweed. While it is not always practicable to plant on clean fallow, where this can be done, serious insect infestation can only take place from dirty fence lines and headlands, and a firm stand may be secured before a high insect population can be reached. In the case of lucerne early spring planting is sometimes possible. The "flea" population gradually diminishes with the advance of summer whereas the growing conditions for the lucerne (if moisture is available) become increasingly favourable. By the following winter the plants should be quite well established and much better able to withstand both lucerne flea and red-legged earth mite attack than freshly sprouted seedlings.

Biological Control.—A species of predatory mite commonly known as the Bdellid mite (*Biscirus lapidarius*)was discovered in this State in 1932 and its main food was found to be the lucerne flea. In permanent pasture lands the mite has shown its ability to exercise a controlling influence on the flea, but it has by no means solved the lucerne flea problem. For many years the mite was distributed by the Department of Agriculture in order to ensure its introduction into the principal clover growing districts. The creature now has a wide range in the lower South-West and wholesale distribution has been discontinued. The

natural spread of the mite is rather slow and some farmers believe in spreading the predators over their paddocks whenever they find a particularly active colony at work. The mite is a little over 1/16th inch in length, reddish in colour, has a long "snout," eight legs and two prominent "feelers."

It has a habit of hiding, particularly during warm spells, under pieces of bark, slats of wood and other suitable cover. Such material and the adhering mites can be collected in a bucket or other receptacle and transferred to areas where the flea is particularly troublesome.



The lucerne flea predator.
(Biscirus lapidarius.)

Chemical Control.—Poison sprays such as arsenate of lead can be effectively used against the pest but under most conditions the use of such poisons are impracticable on account of the risk to stock. A non-toxic spray which has been used with good results to aid in the establishment of lucerne plots and other special areas is lime sulphur, mixed at the rate of one part of concentrate to 60 parts of water. As with all contact sprays lime sulphur should be applied with a strong spray pump in such a manner as to hit as many insects as possible. The weakness of most contact insecticides is that they have no residual or repellent action and consequently reinfestation of treated areas soon takes place.

D.D.T. AND BENZENE HEXACHLORIDE.

Both of these insecticides appeared to offer possibilities of control and during the winter of 1947 advantage was taken of an opportunity to carry out a preliminary trial. Both insecticides were used in association with superphosphate and in dusts made up with pryophyllite. The following treatments were laid down:—

1. Control.
2. Four per cent. D.D.T. mixed with superphosphate used at 2 cwt./acre = 4.25 lbs. pp′ isomer per acre.
3. One per cent. D.D.T. dust 50 lbs./acre = 0.5 lbs. pp′ isomer per acre.
4. Four per cent. Benzene Hexachloride mixed with superphosphate used at 2 cwt./acre = 1.165 lbs. ∝ isomer per acre.
5. Two per cent. Benzene Hexachloride dust 50 lbs. acre = 0.13 lbs. ∝ isomer per acre.

The effectiveness of the treatments was evaluated by a sampling technique designed for the purpose and yielding results as a population count at weekly intervals.

As a check against the population count technique, estimations of damage to the pasture were made at regular intervals. The results obtained from these two sets of data were sufficiently correlated to justify the population sampling technique adopted.

The outstanding feature of this trial was the effectiveness of the Benzene Hexachloride in superphosphate treatment and the disappointing results obtained from the D.D.T. superphosphate treatment.

Further experiments are necessary to determine the most economical and effective means of using this material but the results of the above trial point to Benzene Hexachloride as being a very promising insecticide for this purpose.

SUMMARY.

The lucerne flea is an introduced pest widely distributed throughout the agricultural areas of South-Western Australia.

Cultural methods of control involve fallowing, burning and other methods of weed control as well as spring planting of crops such as lucerne.

It is a winter pest and is most serious as a pest of subterrannean clover and lucerne. A certain degree of control is exercised by a predatory mite (*Biscirus lapidarius*).

Lime sulphur is an effective contact spray but has no residual effect.

D.D.T. was not promising for control of this pest but Benzene Hexachloride was sufficiently effective to warrant further experiments with it.

CALTROP.

(*Tribulus terrestris Linn.*)

C. A. GARDNER, Government Botanist, and R. D. ROYCE, Agricultural Adviser.

THE list of native plants which have proved troublesome to farmers and pastoralists in Western Australia is extensive. A large number of these plants, both in the tropical and sub-tropical north, and in the southern agricultural areas are poisonous, while others are troublesome because of the spiny burrs or seeds they produce. Some of the worst burr producing plants are included amongst the species of *Tribulus,* the most widely distributed of which is *Tribulus terrestris* Linn, commonly known as Caltrop, which produces a burr somewhat reminiscent of that of double gee.

Native to the warmer regions of the Old World, including tropical Australia, Caltrop has proved so adaptable to varying conditions of soil and climate, that it is now a serious weed in nearly every warm temperate country in the world, the main factor in its spread being commercial intercourse between various countries. The Australian plants have proved no less adaptable, and the increasing use of motor transport in the areas where it is native, together with movement of stock from the northern to the southern areas of the State, have resulted in the spread of the plant into the agricultural areas.

It has been reported as a weed from several widely separated districts of Western Australia and has always proved completely adaptable to the soil and climate of each area. The plants have invariably been large healthy specimens spreading over several square feet of soil and producing numerous burrs. It is already well established in some localities, and has been declared a noxious weed in the Dalwallinu, Fremantle, Kondinin, Merredin and Mukinbudin Road Board Districts and the Fremantle and East Fremantle Municipalities. Although it is at times of some value as a browsing plant, Caltrop possesses characteristics which far outweigh its dubious fodder value, and it should always be regarded as a serious weed.

Description.—Caltrop is a prostrate annual plant, the stems of which spread along the ground for a distance of one or two feet from the more or less woody tap root. The stems are usually covered with silky hairs, especially on the young parts. The leaves are borne in pairs, one on each side of the stem, and consist of several pairs of leaflets, the upper surface of which is of a darker green than the lower. The leaves of each pair are unequal, one being only half as long as the other, and having fewer leaflets. The flowers arise from the axils of the smaller leaves, and are borne on a short pedicel or stalk. They are pale yellow in colour, and little more than half an inch in diameter, with ten stamens. Below the petals is a small cup-like organ known as the calyx and consisting of five sepals. When the flower fades the ovary develops rapidly, the five sections or carpels becoming hardened and woody, forming a burr, the five carpels united along their central axes, but falling readily when fully mature, but not shedding their seeds. Each burr is about one quarter of an inch long and almost half an inch broad. In cross section each carpel is wedge shaped, with the two inner faces net-veined. On the dorsal surface there are two stout spines set at an angle to the surface and near the top of the burr; on the opposite end are two smaller spines, sometimes very small, and directed downwards, almost at right angles to the larger spines. Between the two pairs of spines, and running the whole length of the outer surface, is a crest of small pointed protuberances or spines. Each carpel contains two to five seeds.

The name *Tribulus* is derived from the Greek "tribolos," and is the Latin name for some spiny plant; and also for the "Caltrop," a spiked metal ball used as a military instrument in war as an impediment to cavalry. The specific name *terrestris* "found on the earth" refers to the prostrate habit of the plant.

Economic Importance.—The thick mat of burrs produced by a well established growth of Caltrop is capable of causing extensive mechanical injury to stock, particularly horses. The points of the spines penetrate the frog of the hoof and cause painful suppurating sores. Pammel[1] has pointed out that when the burrs are ingested along with other herbage, they may cause mechanical injury to the lining and walls of the stomach and intestines. In addition the plant is liable under certain conditions to be toxic, although no losses due to it have yet been reported in this State.

De Kock[2] in South Africa, proved that when eaten by sheep or goats in the wilted state, this plant caused a condition known as Dikoor or Geeldikkop. Photosensitization of the ears, lips and skin surrounding the eyes, followed by swelling of the head, are the typical symptoms as described by the South African investigators, and similar symptoms were reported from two areas of Queensland during 1936.[5] Caltrop was plentiful in the pastures on the properties concerned, and had been freely eaten by the sheep, resulting in heavy stock losses. Weaners appeared to be most severely affected, but sheep of all ages proved to be susceptible. Pastoralists in New South Wales have also experienced losses in areas where Caltrop was plentiful, and had been eaten by the stock.

Hurst[3] states that from New South Wales experience, the plant appears to be toxic only under certain conditions, namely, when green, succulent or rapidly growing plants are grazed during hot days. Sheep are less likely to be affected when the pasture consists of other species mixed with the Caltrop, or when it is past the succulent stage, and is beginning to dry off. Trouble is usually experienced when sheep are grazing the plant during a period of hot weather following heavy showers of rain.

Control.—As with all annuals, Caltrop is dependent on seed production for its propagation, so that if burr formation is prevented over a given area the plant must eventually be eradicated. Any control measures adopted must be directed towards the prevention of flowering, and must therefore be initiated before the flower buds have opened. Persistence and thoroughness over a number of years are necessary, because of the possibility of seeds remaining in the soil in a viable condition.

Prevention is better than cure, and is always more economical. Seeds can be introduced into clean areas on motor vehicles or machinery, particularly those with pneumatic tyres, and in this connection it is interesting to note that both Caltrop and Double gee have been spread over large areas by virtue of their ability to stick to the tyres of aeroplanes. Stock from affected areas frequently carry the burrs adhering to the wool or hair on their legs, while chaff has also been responsible for the spread of the plant. Farmers can do much to prevent the establishment of the weed on their properties by carefully checking on the district of origin of produce or second-hand machinery before purchase, and close personal inspection before accepting delivery on the property. When plants are found on a previously clean area, they should be hand pulled, and, together with the matured burrs that have fallen on the ground, should be placed in a bag and burned. Where one plant is found, others may appear after further showers of rain, so a constant watch should be kept to prevent any burrs from maturing.

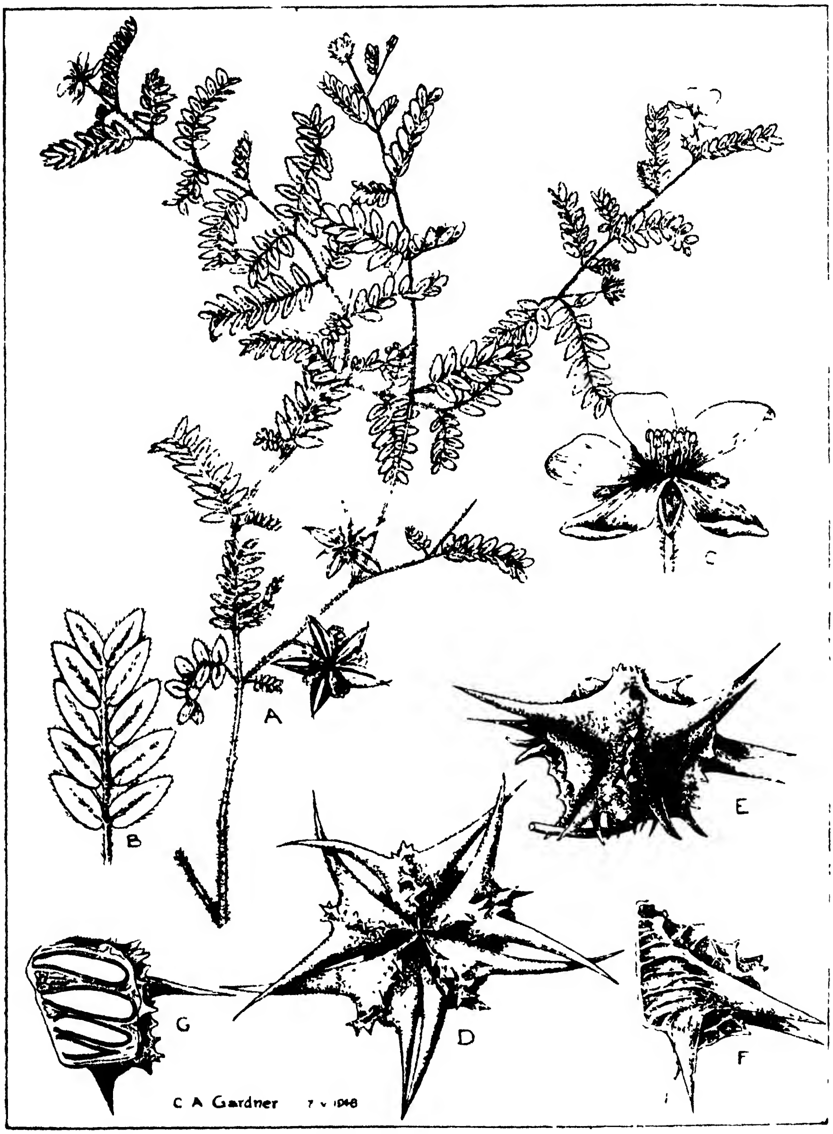
Nothing is known of the longevity of the seeds of Caltrop, but American workers[4] report that a plot on which the weed had been firmly established for some time, was kept free of plants for a period of eight years, and seedlings continued to emerge in undiminished quantities throughout the period of the test. It is reasonable to expect, therefore, that they would be capable of retaining their viability for long periods. Thus it would appear that deep ploughing of affected areas, although temporarily disposing of the pest, would only serve to create a store of seeds in the soil which would be capable of germinating at some future date, when brought to the surface by another deep ploughing.

Fortunately deep ploughing should not be necessary as the young seedlings appear to be readily destroyed by even superficial cultivation. Plants commence flowering at an early stage of growth, and, like Double gee, as early as a week or fortnight from germination are capable of flowering and setting seed. Under favourable conditions the plants are capable of producing an enormous number of burrs, and plants may continue to flower into the winter months. The rapid maturing nature of Caltrop plants makes it of particular importance that cultivation should be commenced as soon as the plants appear. As with all problems associated with weed control, energetic measures repeated as soon as weed growth makes it advisable, are the key note of success.

Efficient chemical control of Caltrop is possible at a relatively low cost by the use of diesel oil. American workers[4] have shown that when the oil is used as a spray, it not only kills the green plant, but it is also absorbed by the tissues of the burr and apparently has a toxic effect on the seeds, rendering them non-viable. Unadulterated diesel oil gave more efficient results than oil as an emulsion in water. Unfortunately green burrs do not absorb the oil as readily as mature

ones, while those which are covered with soil at the time of spraying will be unaffected, and will germinate when conditions are suitable. Additional sprays will probably be necessary to kill the plants which germinate from these burrs.

Diesel oil has little cumulative effect on the soil on which it is sprayed, nor is it capable of killing the roots of perennial plants, except by repeated applications. Subsequent growth of both annual and perennial plants will be completely normal on the sprayed areas in the following season.



Explanation of Plate.

A, Habit of plant. B, Leaf (enlarged). C, Flower. D, Upper view of burr. E, Lateral view of burr. F, A separate carpel (lateral view). G, Longitudinal radial section of carpel, showing seeds.

Fremantle, W. Australia. March, 1948.

Farmers normally have quantities of sump oil on their properties, and this substance could be used to good effect in combating small areas of this weed. Like diesel oil it will kill off all the plants which are covered by it, but it is doubtful whether it will penetrate the tissues of the burr and kill the seeds. However, if a good coating of oil is given, and a layer of straw or dried bushes is spread over the patch, the heat of the resulting fire will kill a large percentage of the seeds, if not all of them. The burrs mature rapidly and fall very easily, so that if plants are disturbed at all after the burrs have matured, a large number of them may be scattered over the surface of the soil, and so increase the size of the area affected. Under no circumstances should the plants be raked up into heaps for burning, unless the shed burrs are also carefully collected and destroyed, but should be burned where they grew, individually if necessary.

Chemical weedicides such as sodium chlorate, sodium arsenate and the hormone preparations are effective in killing off the green plants, but they have no effect on matured burrs, and repeated sprayings, probably over a number of years, would be necessary for eradication. Spraying programmes using these preparations would be very expensive and uneconomical.

Summary.—Caltrop is native to Northern Australia and is becoming established in the agricultural area, where it has already been declared a noxious weed in several Road Board Districts.

The spiny burrs are capable of causing mechanical injury to stock.

The plant is toxic to sheep and cattle, mainly when succulent plants are eaten during hot weather. Losses are sometimes heavy.

Control is possible by using diesel oil as a spray; this is effective in killing both the green plants and the matured burrs.

Isolated patches should be burned without being raked into heaps, and burrs should not be buried by deep ploughing.

REFERENCES.

1. Pammel, L. H., 1911. Manual of Poison Plants. Iowa.
2. Koch, G. de, 1928. Journ. South African Vet. Med. Assoc., i., 39.
3. Hurst, E., 1942. The poison Plants of New South Wales.
4. Robbins, Crafts and Raynor, 1942. Weed Control.

RAGWORT.

(*Senecio Jacobaea L.*)

C. A. GARDNER, Government Botanist and R. D. ROYCE, Agricultural Adviser.

THE importance of the early recognition of a serious weed, and its prompt destruction has been demonstrated very clearly in the case of ragwort in Western Australia. In January, 1940, a specimen of ragwort was received at the State Herbarium from the secretary of the Manjimup Road Board, who stated that Mr. J. J. Mottram noticed an unusual plant on his holding, and, suspecting that it might be a weed of some consequence, had handed a specimen to him to be forwarded for determination. This specimen was the first record of ragwort in Western Australia. An officer immediately visited the district to investigate the reported occurrence, and found that the affected area comprised about one hundred

square yards in a pasture paddock where the large trees were dead but still standing. The plants of ragwort were mainly clustered together and had the appearance of having originated from a single, or but few associated plants.

The history of the occurrence of the weed suggested that it had been introduced in pasture seeds from New Zealand, about five years previously. The prompt recognition of the weed by Mr. Mottram, and the interest and co-operation of the road board secretary, resulted in the destruction of the plants before any seed had been formed. Specimens of the weed were deposited with the secretary of the Manjimup Road Board for exhibition, in order that the plant might be recognised by others. The result was the detection of another small occurrence on a property not far removed from the original area. All plants were grubbed and burned, and the areas have been inspected by an officer of the Agricultural Department on several occasions during the subsequent years, but no further plants have been located.

In March of this year, another occurrence was reported, this time from the Walpole district, where Mr. J. B. Amos found a single plant growing on a neighbour's property. Recognising the potentialities of the plant from its growth habit, and suspecting that it would be an objectionable addition to the weeds of the district, he forwarded it to the Department of Agriculture for identification. The seriousness of the new find was at once apparent as the plant was well advanced in flower, and seed formation had already been commenced. Arrangements were made with the Rural and Industries Bank for the Inspector from the Denmark Branch to make a survey of the district in an effort to locate any further plants. Three affected areas were found, one of major importance, the other two showing only scattered plants.

In the large area, on a property recently purchased by the present owner, the plants occurred scattered over the greater part of a two-acre paddock. In one corner, where the original plants had apparently been located, the infestation was quite heavy, and showed signs of the plant's capacity to crowd out pasture species. The thick mat of radical leaves had practically killed the paspalum, and only bracken and other strong-growing weedy types of plants were still able to withstand the competition.

From this original source of infestation, seeds had not only been distributed over the rest of the paddock, but in all probability they had been blown on to the neighbouring properties. Odd plants were found many chains away from the main infestation, and it is probable that many other seeds are lying dormant in the ground and will eventually germinate, so that constant and thorough measures will be necessary for a number of years if the weed is to be eradicated. In a district with such a potential in dairy production, and with so much at stake, the weed is a particular menace, and merits the most vigorous community campaign of destruction.

From the past history of the area, and the present extent of the weed, it is apparent that the original plants must have appeared at about the same time as those reported at Manjimup in 1940. In the one case, however, the possibilities of the plant were recognised fairly early, and its eradication was a comparatively simple matter. At Walpole, on the other hand, nothing was done about the weed, despite the fact that stock were reputedly lost after grazing in the paddock, probably due to the presence of the ragwort. In the intervening years the plants have spread, until now they threaten to take possession of several acres of fertile country, and their eradication will be a major task.

Ragwort has been proclaimed in the *Government Gazette* as a noxious weed for the State of Western Australia, and dairy farmers in the lower South-West are urged to be on the look-out for the plant, and to take immediate steps to eradicate any that are found.

Ragwort is a perennial herb native to Europe, Siberia and North-Western India, but is recorded as a naturalised alien in North America, New Zealand, and Victoria. It is toxic to stock. In New Zealand large areas have become infested —in places to the exclusion of most other vegetation.

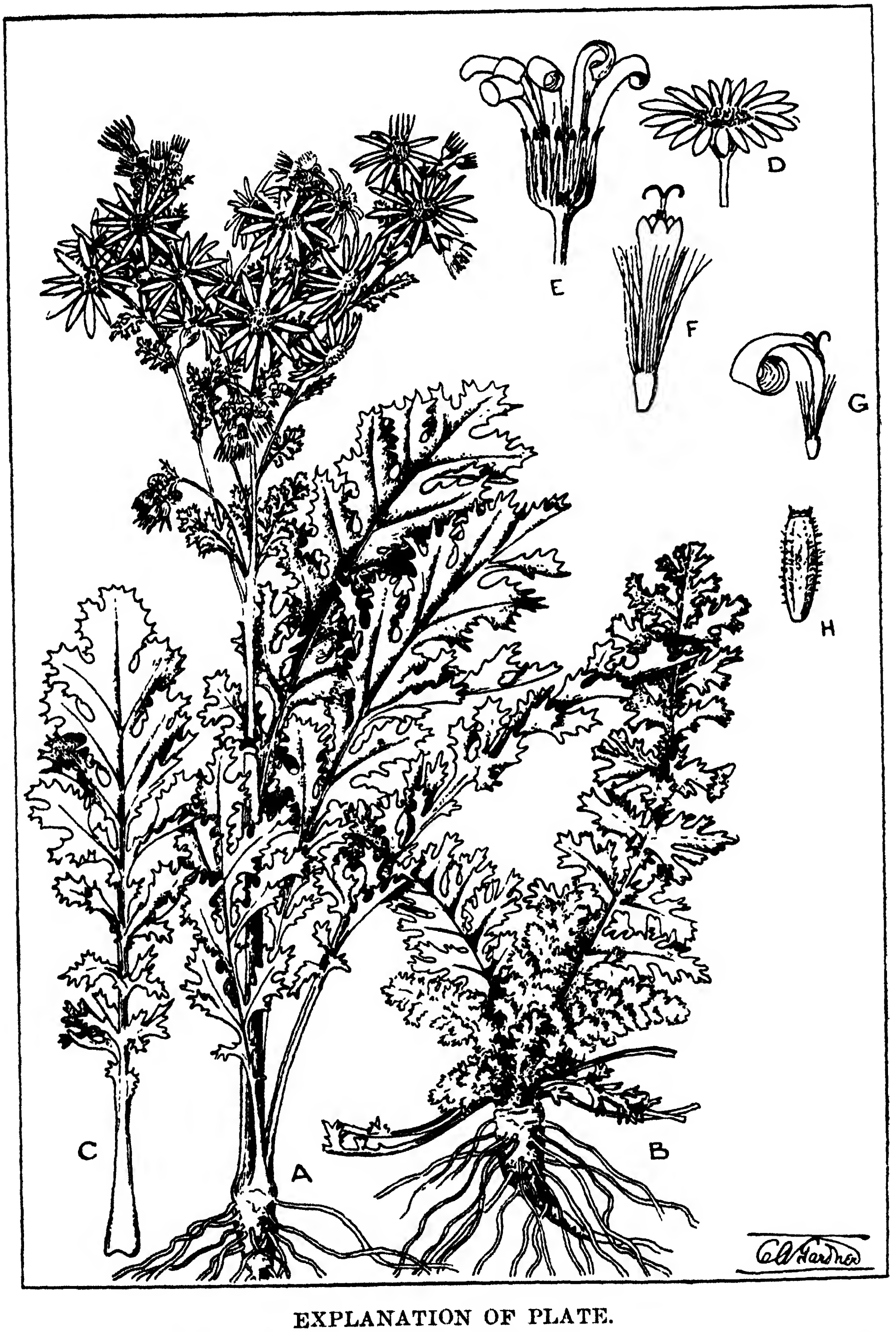
In addition to the fact that ragwort is a robust perennial capable of reproducing itself vigorously from its roots, it is also a remarkably free-seeding species adapted for rapid proliferation. The seeds may lie dormant in the soil for some years, and germinate when conditions prove favourable. It is because of this latter characteristic that some years must elapse before complete extermination can be claimed with certainty.

Toxicity.—Ragwort has been proved toxic in Britain, in Canada, New Zealand and Victoria. Horses and cattle are most likely to be affected, and the slow poisoning of dairy cattle has caused much concern. The toxic effect is cumulative. Poisoning under natural conditions is a slow process because an animal does not usually eat enough of the weed at one meal to cause acute poisoning; on the other hand, through its cumulative action the amount of poison which becomes available is sufficient in time to cause very serious symptoms which often end in death. Murnane[1] states that after grazing for twelve months or more on areas where ragwort is plentiful, cattle develop typical symptoms, exhibiting dullness, loss of appetite, and a jaundiced condition of the eyes, together with a peculiar staring appearance. There is loss of weight and, in the case of lactating animals, a very marked diminution of the milk supply. The milk has a peculiar odour and pronounced acrid flavour rendering it quite unfit for use. The affected animal frequently exhibits a scabby condition of the skin, especially in the udder and teats. In the later stages there is impaired vision, staggering gait, persistent diarrhoea, a marked thirst and progressive loss of condition. The milk supply ceases, food is not taken, the animal becomes weaker, drops down and eventually dies—frequently in a swamp or water hole into which it has wandered in order to quench its insatiable thirst.

The actively poisonous agent in the plant appears to be one of two or more alkaloids which have been extracted in more or less pure form from various species of ragwort. It would appear that, although animals which had received a toxic amount of ragwort over a certain period, may seem healthy at the time when feeding on the material is discontinued, they nevertheless develop acute symptoms of poisoning and die at a later period. Thus, in cases investigated in Britain some of the animals did not show definite symptoms until twelve days or more after feeding tests with ragwort had been discontinued[2].

There is no cure for ragwort poisoning, and prevention resolves itself into the eradication of the plant. Sheep are less affected than cattle and horses, and when managed correctly provide a practical measure of control.

Eradication and Control.—The prevention of seed-formation on the plants is a very important factor in the control of ragwort. Where only a few plants occur, careful grubbing represents the safest method of control. The roots and the entire rootstock should be removed, heaped and burned, this operation being carried out before the flowers have expanded, since any flowers present on severed plant parts may develop mature seeds because of the sappy nature of the stems; consequently every part of the plant should be destroyed.



EXPLANATION OF PLATE.

A. Habit of plant showing stock and basal leaves, also the apical portion with stem leaves and flowers. About sixteen inches from the middle has been removed. B. Stock with a rosette of basal crisped leaves. C. Radical leaf. D. Flower-head. E. The same showing the involucre of black-tipped bracts. F. Disc floret. G. Ray floret. H. Fruit ("seed").

Northcliffe, W. Australia. January, 1940.

Since the seeds retain their vitality in the soil for a number of years, one year's seed production will necessitate a careful examination of the infested area for several years after grubbing. Spasmodic cultivation only serves to divide the rootstocks and spread the weed. Any cultural work must be thorough and repeated as often as necessary, and it is important that the affected area should be treated as a unit in this connection.

Where the plant is abundant and widespread, sheep have proved a practical means of control. This method has been attempted in many places in New Zealand with success and has resulted in practically no abnormality amongst the sheep, but, on the other hand, mis-managed efforts on the part of other settlers have resulted in failure with heavy stock losses. Given proper treatment, a measure of control has been secured in two or three years. Very good results have been achieved by stocking heavily with sheep when the ragwort is young and juicy. Small paddocks are desirable, and old animals have been found to be less affected than lambs, and at the same time more severe in their grazing.

Both sodium chlorate and arsenic pentoxide have proved effective when sprayed on ragwort, complete destruction having been obtained from the application of a five per cent. solution of sodium chlorate. This treatment by sodium chlorate has proved more effective during showery weather than during particularly dry weather, and Dean[3] states that as the plant reaches the flowering condition a weaker solution than that required while the plant is actively growing may be used. An application as low as two per cent. has proved effective when applied to plants in flower. The chemical control of weeds is, however, an expensive method, and usually is not economical for large areas.

Description of Plant.—Ragwort grows to a height of from two to three feet, from a short thick rootstock which divides with age. The stems are strictly erect, simple or branched above, and usually a bright purple in colour. Leaves pinnately divided, with ovate, obovate or narrow coarsely toothed or pinnatifid segments, the terminal ones large and confluent, the lower smaller, all glabrous or loosely downy, especially on the lower surface: basal leaves on long petioles, the uppermost sessile. Flowers yellow, in compact or broad terminal corymbs; involucral bracts linear, tipped with dark brown or black points, the outer bracts few and very small. Ray florets yellow, usually 12 to 16 in number, linear-oblong, spreading; disc florets numerous, yellow. Achenes of the disc florets shortly and coarsely hairy, the achenes of the ray florets glabrous.

For further particulars see the accompanying plate. The young plants have dense crisped radical leaves and the thick stock develops early, the stems in the local plants are purple in colour.

REFERENCES.

1. Ragwort Poisoning of Cattle in Victoria—W. Murnane, Journ. C.S.I.R., Vol. 6, pp. 108-110.

2. Report of the Board of Agriculture's Chief Veterinary Officer (1917).

3. Control of Weeds with Chlorates—J. W. Dean, New Zealand Journ. of Agric., Aug. 20, 1931.

APPLE SCAB OUTBREAKS SEASON 1947-48, WITH SPECIAL REFERENCE TO THE INTRODUCTION OF THE DISEASE BY INFECTED BUDS ON IMPORTED NURSERY STOCK.

W. P. CASS SMITH, Government Plant Pathologist.
H. L. HARVEY, Assistant Plant Pathologist.
OLGA GOSS, Assistant Plant Pathologist.

SUMMARY.

Western Australia is one of the few apple growing countries in which apple scab (Venturia inaequalis) is not firmly established. Outbreaks which have occurred here from time to time have been eradicated with great difficulty. Available evidence indicates that these outbreaks have originated from imported nursery stock, and not from diseased fruits introduced contrary to regulations. Measures requiring imported nursery stock to be free of leaves and dipped in Bordeaux mixture have proved ineffective, for after large importations of nursery stock from Victoria and Tasmania in winter, 1947, numerous new apple scab outbreaks developed next season, which were confined to these newly introduced trees or stocks.

Bud-scale infections were demonstrated on Pomme de Neige seedling stocks from Tasmania, and Northern Spy stocks and the Cleopatra variety from Victoria imported during winter 1947. This is a new record for Australia.

Attention is drawn to the discovery in infected buds of two-celled spores and perithecia-like bodies closely resembling the ascospores and perithecia of V. inaequalis. An exact determination could not be made, however, as ripe perithecia containing asci and ascospores were not found.

Control measures recommended for the eradication of the 1947-48 outbreaks are listed and the view is expressed that the best method of excluding apple scab from Western Australia is to propagate and use our own nursery stock.

SINCE 1930 when apple scab was first recorded in the State, several outbreaks of the disease have occurred here, but each has been successfully eradicated. (1, 2 and 3).

Eradication has only been achieved, however, by the stringent measures laid down by the Department of Agriculture and the noteworthy co-operation of growers concerned, in carrying them out conscientiously. That these outbreaks should have occurred is not surprising because the majority of our apple orchards have been planted with nursery stock imported from Victoria where the disease is both serious and widespread.

It is true that the disease, should it become established, would probably never be as serious here as in Tasmania or Victoria, owing to the less suitable climatic conditions for its development, but its control would considerably increase production costs, and might well cause the abandonment of orchards of low productivity.

ORIGIN OF OUTBREAKS IN WESTERN AUSTRALIA

All available evidence indicates that outbreaks of apple scab in this State have originated from nursery stock imported from other places where the disease exists. The introduction of apple fruits is prohibited by regulation under the Plant Diseases Act, and although this is at times contravened unwittingly, no outbreak can definitely be attributed to introduction of diseased fruits.

There are three ways in which apple scab may be introduced with imported nursery stock.

1. by infected twigs or buds.
2. by infected leaves.
3. by superficial spore contamination.

In some countries, e.g. England and Ireland, the apple scab fungus has long been known to over-winter on infected one-year old twigs, and more recently over-wintering by infected buds has also been demonstrated. (4, 5.)

In Australia, however, neither of these modes of carry-over had been recorded up to the commencement of the past season.

As a safeguard from the introduction of the disease by means of infected leaves, and superficial spore contamination, measures prescribed for some years now by Superintendents of Horticulture have required that all apple nursery stock entering Western Australia should be free of leaves, and dipped in strong Bordeaux mixture.

BUD-SCALE INFECTIONS ON NURSERY STOCK IMPORTED DURING WINTER 1947.

During the winter of 1947 large importations of nursery stock were again made, for the first time for several years. These were obtained mainly from Victoria, and to a lesser extent Tasmania, and comprised some 80,000 young apple trees, and seedling or other stocks. Despite the application of the measures mentioned, these importations were followed by further outbreaks of apple scab during the ensuing 1947-48 season, as the disease was detected in twenty-one orchards, and two nurseries.

It is clear that these were in no way connected with any previous outbreaks for no trace of the disease had been found anywhere in Western Australia during the preceding five years despite careful yearly searches, and more significant still *all these new outbreaks developed in young orchards or nurseries, never affected previously with apple scab and the disease was confined entirely to newly planted young trees or stocks imported from Victoria and Tasmania during the winter of* 1947.

The circumstances were such, therefore, that some unusual method of disease introduction was suspected and this was supported subsequently by field observations.

Fig. 1.
Micrograph of infected bud scale, showing the stroma and conidial stage of *V. inaequalis.*

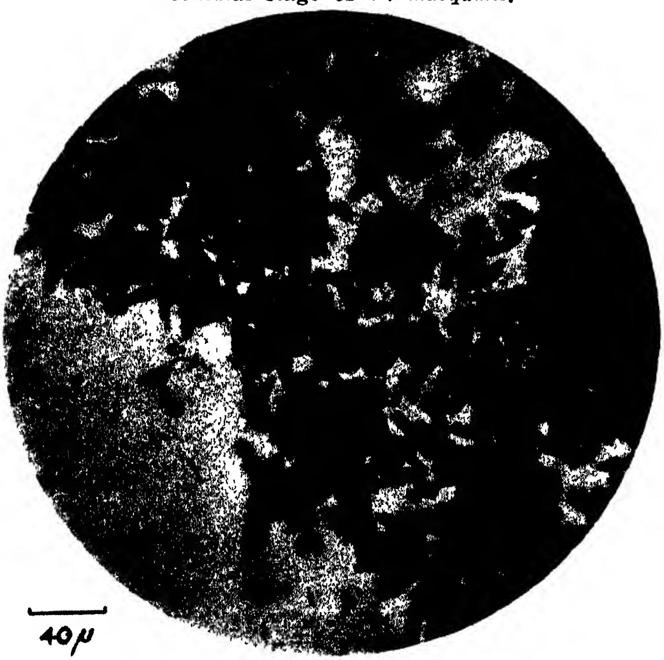


Fig. 2.
Micrograph of infected bud scale showing the typical conidial stage of *V. inaequalis.*

The first outbreak, fortunately, was detected very early in the growing season by a Horticultural Field Officer in a Pemberton nursery. The Assistant Plant Pathologist, Mr. H. L. Harvey, who visited this outbreak, reported that although so early in the season, leaf infection was particularly severe, and that in many cases the whorl of leaves arising from a single bud were all badly infected and distorted even though the leaves were still very immature. Primary symptoms of this kind appeared to be better causally related to infected buds than to infection from over-wintering leaves.

McKay, who has done considerable work on bud-scale infections in Ireland, has recorded similar symptoms, and regards them as being a typical result of primary infection arising from diseased bud scales. (5)

Some hundreds of diseased specimens secured from this and later outbreaks, were therefore laboriously examined microscopically for evidence of twig or bud-scale infections. Twig infections were not seen, but infected dormant buds were detected on Pomme de Neige seedling stocks imported from Tasmania, and on Northern Spy stocks and the Cleopatra variety imported from Victoria.

Dormant buds on apical stems or terminal stem portions were the chief regions where infection was noted, but infected buds were also detected at times at considerably lower levels on the stems.

In the field, also, early leaf symptoms of a type, indicating, it is believed, that infected buds were the primary source of inoculum, were most evident on the growth from terminal or apical buds, according to reports received from Horticultural Officers T. Miller and R. C. Owen.

MICROSCOPIC DETAILS.

Preparation of Slides.

Dormant buds (i.e. those showing no sign of swelling) were treated for examination by boiling in 20% potassium hydroxide, until the bud scales began to separate. Generally this took from 3-5 minutes. They were then well washed in water and transferred to a slide where the bud scales were teased apart and stained in cotton-blue in lacto-phenol.

Conidial Pustules.

Conidial pustules were discovered on some bud scales, both stroma and conidia being abundant. The conidia were typical of *Fusicladium dendriticum* in shape and size, averaging 20 microns x 9 microns (Figs. 1 and 2). Conidia of three types were noted, namely, unicellular, one septate and germinating spores.

The mycelium was of two kinds; brown, septate, unstained mycelium, and dendritically branched stained mycelium.

The fact that some of the spores were septate, and others germinating, and that dark unstained mycelium was present, would seem indicative of age, and hence that the infections were of long standing.

It is noteworthy, however, that stained mycelium was also seen which would indicate that it was still active. In support of this statement, it was noted that in some buds, internal leaf rudiments were found with an occasional spore, and young, stained mycelium showing typical dendritic branching.

? Perithecia and Ascospores.

During the examination of infected bud scales a group of four two-celled spores was discovered. These averaged 12 microns x 6 microns in size and appeared to be typical ascospores of *V. inaequalis* (Fig. 3). Their discovery in this habitat was of great interest, particularly as their occurrence could not be related to discharge from perithecia in over-wintering leaves, in view of the circumstances already explained.

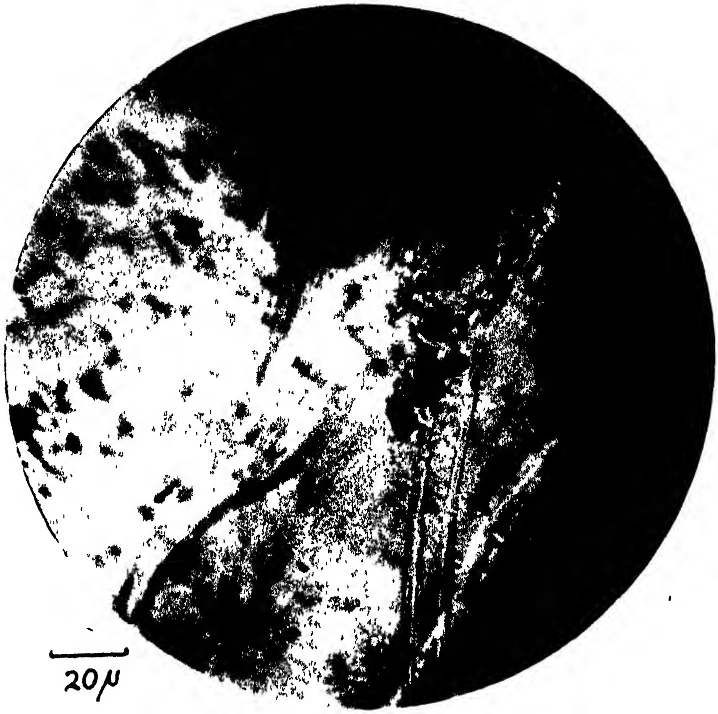


Fig. 3.
Micrograph showing group of two-celled spores closely resembling the ascospores of *V. inaequalis*, found in association with infected bud scales.

A search for perithecia also was therefore made, and ultimately a small number of black, roughly spherical, perithecia-like bodies, closely resembling those of *V. inaequalis*, were found in diseased bud scales showing the conidial stage (Fig. 4.)

The buds in which these were found were very shrunken and appeared dead.

These ? perithecia varied from 72 microns to 120 microns in diameter, possessed short necks, with an occasional spine about the ostiole region. The mycelium surrounding these bodies was very similar to that of the scab fungus and fitted with that seen in bud scales showing the conidial stage (Fig. 5).

Unfortunately, an exact determination could not be made as these perithecia-like bodies proved to be empty, and ripe perithecia containing asci and ascospores were not found.

There appears to be no published record of the occurrence of the perithecia of *V. inaequalis* in bud scales, and, therefore, as the matter was one of importance in connection with our knowledge of the life cycle of the fungus, specimen slides were referred to Dr. S. P. Wiltshire, Director of the Commonwealth Mycological Institute, Kew, London. In his reply, Dr. Wiltshire stated that he "would not venture an identification from the slides alone" . . . . . "Although unable to confirm the presence of perithecia on the bud scales, the conidial state was present in profusion and one would therefore not be at all surprised if the perithecial state occurred as well". It is hoped that by reporting these observations, together with Dr. Wiltshire's comments, interest will be stimulated in countries where apple scab is wide-spread, and bud scale infections occur, which will lead to the clarification of this matter.

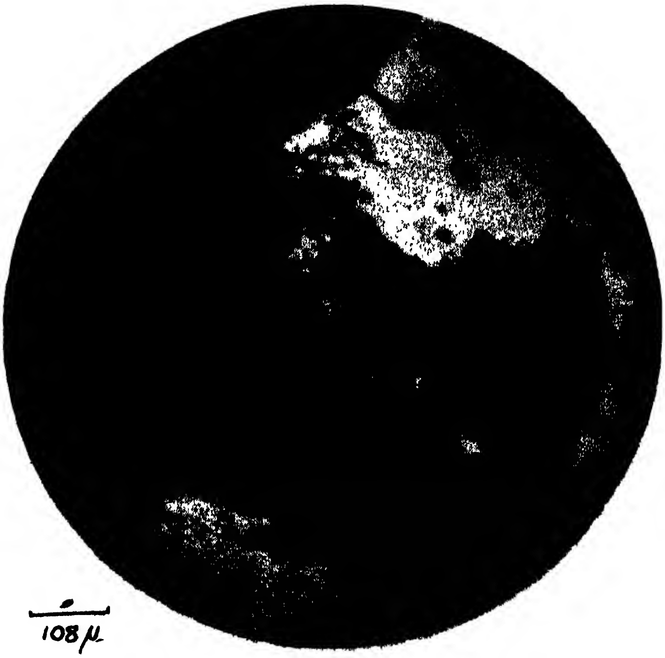


Fig. 4.
Micrograph showing ? perithecia of *V. inaequalis* found in infected bud scales.

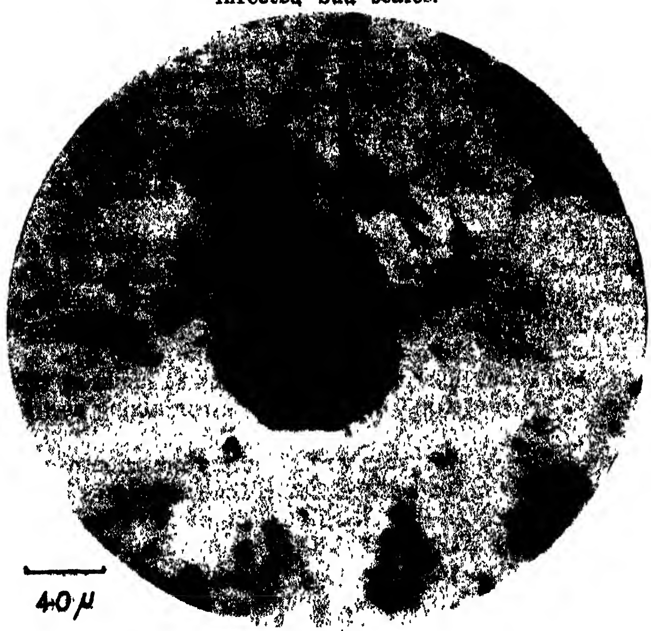


Fig. 5.
Micrograph showing ? perithecium of *V. inaequalis* more highly magnified. Note associated mycelium which is very similar to that of the apple scab fungus, and the conspicuous ostiole. This fruit body is the same as the lowest one shown in Fig. 4.

CONTROL MEASURES.

In view of the early suspicions (later confirmed in the laboratory) regarding the introduction of the disease by infected buds, drastic measures were recommended for the eradication of these outbreaks.

For commercial orchards these recommendations included the complete destruction of plantings of a variety in which apple scab was detected, and the cutting back to basal dormant buds of any adjacent plantings of other varieties.

Complete destruction of diseased plantings of a variety was amply justified, for cutting back to dormant buds might still have yielded infected growth. For nurseries the recommendations included the destruction of all stocks showing the disease, and the cutting back to ground level of the remainder, together with a thorough spraying of the area with a suitable fungicide.

In all, approximately 3,700 young trees or stocks were destroyed by field officers, and some 19,000 trees or stocks cut back.

In the light of this new knowledge on the transmission of the disease by infected buds, the question of further importations of nursery stock from infected areas into Western Australia must be carefully considered.

No treatment is known which will, with certainty, disinfect buds which are diseased, for any treatment capable of doing so would also kill the buds.

Only two alternatives are considered possible, either complete exclusion, or the introduction of nursery stock under quarantine, which would be extremely difficult, if not impossible to carry out.

Undoubtedly, the best method of excluding apple scab from this State, is to propagate and use our own nursery stock, and recently regulations have been promulgated under the Plant Diseases Act, which it is hoped will bring about this result.

ACKNOWLEDGMENT.

Grateful acknowledgement is given to Dr. S. P. Wiltshire, Director of the Commonwealth Mycological Institute, for his examination of, and expression of opinion on, the slides forwarded to him.

LITERATURE CITED.

(1) Pittman, H. A. 1930 "Black Spot or Scab of Apples and Pears in Western Australia." W. Aus. Jour. Agric. Vol. 7 (2nd Ser.) pp. 241-263.

(2) ——————— 1936 "Black Spot or Scab of Apples." W. Aus. Journ. Agric. Vol. 13 (2nd Ser.) pp. 20-29.

(3) Cass Smith, W. P. 1940 "Black Spot or Scab of Apples. Serious New Outbreaks Recorded in the Albany and Manjimup Districts." W. Aus. Journ. Agric. Vol. 17 (2nd Ser.) pp. 56-67.

(4) Salmon, E. S. & Ware, W. M. 1931 Gard's Chron. 89 pp. 437-438.

(5) McKay, R. 1942. "Apple Scab and its Control at Glasnevin in 1939, 1940 and 1941." Eire Journ. Agric. Vol. 39 No. 1 pp. 46-79.

ZINC DEFICIENCY OF FLAX.

W. P. CASS SMITH, Government Plant Pathologist and H. L. HARVEY, Assistant Plant Pathologist.

SUMMARY.

Zinc deficiency of flax was first recorded in 1943 but only became serious in 1945.

Symptoms include dieback of the tip of the young plant, bronze leaf spotting and leaf rosetting, followed in most cases by regrowth of the stunted main stem or production of lateral shoots from the base.

Fertiliser incorporating zinc sulphate applied at planting time yielded healthy plants, and analyses of plants from zinc treated plots showed a much higher zinc content than those which had received no zinc. Straw evaluations also showed improvement in the yield and quality of fibre with zinc applications.

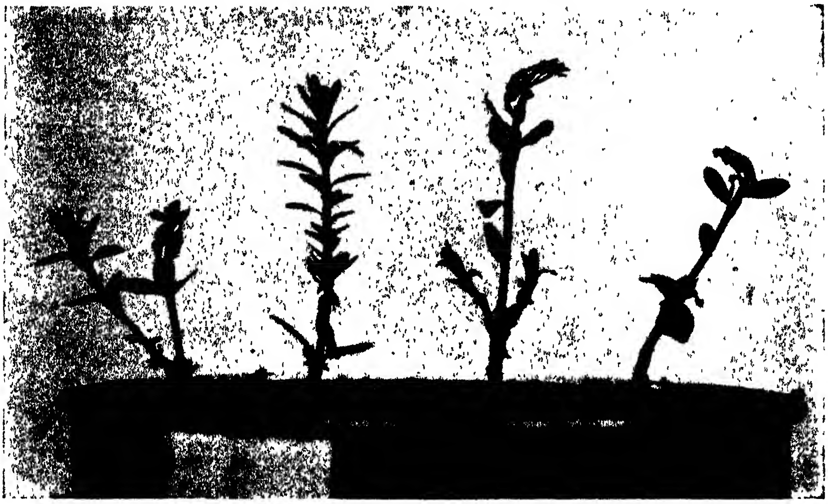
Factors associated with this disorder have been noted.

IN the course of a flax disease survey in 1943 two crops in the early stages of growth showed a "dieback" condition which was diagnosed as being due to zinc deficiency. These were recorded in the Donnybrook and Muradup districts respectively. Analyses of plant samples showed that the zinc content of the diseased plants was approximately only one half of that of the healthy plants. A preliminary trial in which recovery of some of the affected plants was attempted by the application of zinc sulphate was unsuccessful, due probably to the fact that it was applied too late in the season.

Zinc deficiency of flax did not appear to be of economic significance in Western Australia till 1945 when a dieback and stunting of flax crops in the Boyup Brook area was reported to this department. The property of Mr. D. Hack was inspected towards the end of July after some weeks of abnormally heavy rains, when it was noted that more than 50 per cent. of the crop was no taller than about two inches, in contrast with healthy patches which had reached a height of 10 or 12 inches. Most of the affected areas were badly water-logged. The condition was found to be due to zinc deficiency, and surveys made later in the season showed that it was universally present in the flax areas and for the most part serious. Aspects of zinc deficiency of flax in South Australia have been discussed by Adam and Piper (1944) and in Victoria by Millikan (1946).

SYMPTOMS.

The symptoms observed at the above site and subsequently in other crops were in the most severely affected plants, the death of the few topmost leaves and growing point when the seedlings were only an inch or two tall. Associated with this dieback was often found the production of one or two lateral shoots from the axils of the lowermost leaves. All stages of this second growth were seen from the mere swelling of the lateral buds (Fig. 1d) to the elongation of the side shoots up to about two inches. (Figs. 1c and 2a.)



a b c d

Fig. 1.

(a) Rosette of leaves at tip of stunted main stem with bronzing and death of leaves beneath. A well developed side shoot has grown from a lower bud. (b) A rosette of leaves is seen half way up the stem. (c) and (d) Dieback of tips with side shoots developing.

(Photo. by Government Photographer.)

a b c

Fig. 2.

(a) Dieback of main stem with well-developed side shoots. (b) Rosette of leaves nearly halfway up stem shows point where growth was temporarily retarded. (c) Premature leaf drop. A few leaves are showing bronze spots. In (b) and (c) the main shoot has resumed normal growth.

(Photo. by Government Photographer.)

a b c

Fig. 3.

(a) Bronzing and death of leaves just below the tip of the main stem with the production of a side shoot. (b) The tip of the plant sometimes bends over at the point where stem necrosis occurs. (c) Bronze spots on the lower and middle leaves.

(Photo. by Government Photographer.)

a b c

Fig. 4.

(a) An early stage of recommencement of normal growth of the tip beyond the rosette of leaves. (b) and (c) Bronzing and death of leaves and stem near the top of the stem where a rosette of leaves has formed.

(Photo. by Government Photographer.)

An earlier symptom is the bronzing and death of the leaves and stem just below the growing tip, which may also be accompanied by the development of lateral shoots (Fig. 3a). Not uncommonly the tip of the seedling is caused to bend over where this stem necrosis occurs (Fig. 3b).

Apparently the commonly occurring symptom of bronzing and death of the leaves and stem below the top of the plant is preceded by a fairly conspicuous rosetting of the leaves in that area. (Figs. 4b, 4c, 1a.) The rosette would appear to result from the growth being temporarily retarded. If seasonal growing conditions become worse the leaves and stem at that point die, but if they improve the tip proceeds to grow on normally, leaving a curious rosette of leaves on an otherwise normal-looking stem. A plant in which normal tip growth has recommenced but is only in the early stages is seen in Fig. 4a. Fig 2b shows a plant which has grown on about two or three inches beyond the rosette.

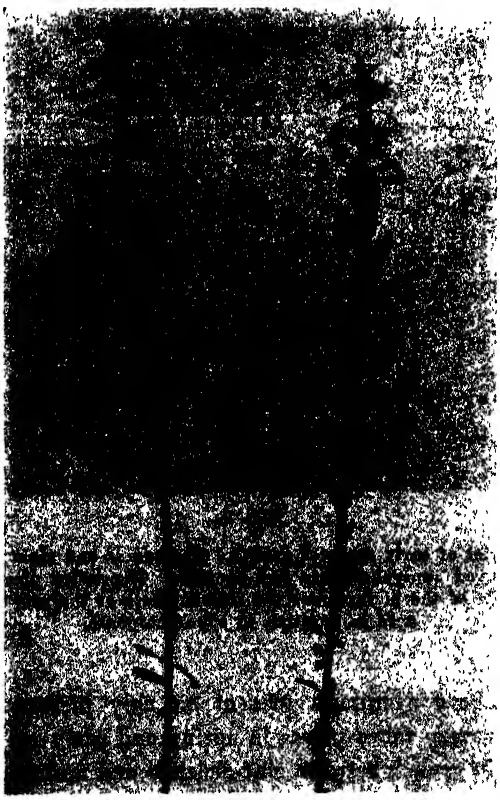


Fig. 5.

"Mild" symptoms of zinc deficiency, namely the occurrence of bronze spots and tips on the leaves followed by a yellowing and premature leaf fall. The height of these plants compares favourably with healthy plants.

(Photo. by Government Photographer.)

A symptom which is not so conspicuous in the field is the occurrence of bronze to black spots on the leaves. It is, of course, often found on plants showing die-back, stunting and rosetting, but quite large patches were seen where none of these severe symptoms occurred. The plants compare favourably in height with healthy plants, but show in the early stages roughly circular bronze spots on the leaves and a bronze colour at various distances back from the tips of the leaves (Fig. 5). This may be followed by a yellowing and premature fall of the affected leaves.

Viewing at a short distance adjacent affected and unaffected patches in the field the bright green colour of the latter contrasted with the dull green of affected patches. Furthermore, where the trouble was very severe the colour tended to be white or sometimes brown if there were a preponderance of young plants with dead tops.

Fig. 6.

Zinc-fertiliser trial at early stage of growth. The sparse and stunted plants in the foreground received superphosphate but no zinc. The taller plants in the strip across the middle of the picture received zinc sulphate at the rate of 15 lb. to the acre in addition to superphosphate.

(Photo. by G. H. Burvill.)

Whereas the above symptoms present an ugly picture during the winter months, a rapid recovery takes places in spring and early summer till at harvest time the difference in growth between zinc-deficient and normal plants becomes less obvious. At this stage one of the side growths has become dominant on plants where the main steam has died back in the early stages and evidence of the original damage becomes much less marked. The average height of such plants was found to be three to five inches shorter than normal plants, and the stand considerably thinner. Other points of difference are set out below in the results of experiments.

ZINC-FERTILISER TRIALS.

An exploratory field trial was conducted in 1946 on the property of Mr. W. Hack to test the effect of applications of zinc fertilisers on the incidence of die-back. The area selected had suffered badly from the trouble in the 1945 season. The trial was laid out in large parallel blocks which were drill-sown and alternate blocks were dressed with super. only and super. with zinc sulphate (15 lb. per acre). In each case the super. was applied at 1 cwt. per acre. Observations made in mid-August showed freedom from dieback in all the zinc-treated blocks, which contrasted with the zinc-deficiency symptoms occurring in the blocks treated with super. only. The contrast was greatest at the lowest end of the experimental area where the ground was excessively wet. Here the zinc-treated plants were six to seven inches in height and almost free from zinc-deficiency symptoms, but where no zinc had been applied most of the plants were suffering from dieback and were only one or two inches high (Fig. 6). Plant samples at this stage of growth were taken from each of the two treatments and results of chemical analyses were:—

Treatment	Zinc (parts per million)
Super only	16
Super + zinc sulphate at 15 lbs. per acre	41

Soil pH* determinations which were made at the same time from the untreated block resulted in pH 6.0 at 0 to 6 inches depth, pH 6.1 at 6 to 21 inches and pH 6.3 at 21 to 30 inches. A number of determinations made on other soils where commercial crops were affected resulted in pH figures of the same order.

Analyses for zinc content were also made on plants taken from affected commercial crops. The results in parts per million of zinc were 16 to 17 for plants showing severe symptoms, viz., dieback, and 22 for "mild" cases, viz., bronze leaf spotting only, as illustrated in Fig. 5.

In mid-November the above experiment was examined and zinc treated blocks were three to five inches taller, more mature, more uniform in height and density of stand, freer from weeds and apparently more uniform and finer in straw diameter. Exact yield data were not obtainable due to damage by stock.

An adjacent trial, however, of similar layout, using only 10 lb. of zinc sulphate per acre, was harvested and the zinc-treated blocks yielded 33 per cent. higher than the remainder. In addition, straw evaluations which were kindly carried out by the C.S.I.R. Flax Research Laboratory, showed that the application of zinc gave an increase in length of straw, in the yield of fibre per ton of straw and improved the grade of fibre. Details of the evaluations are presented in the table hereunder. (Tisdall, 1947.)

*All soil examinations were made by Mr. G. H. Burvill, formerly Plant Nutrition Officer.

STRAW EVALUATIONS

Treatment.	Length (inches)	Appearance.	Ret. Loss per cent.	Fibre Yields per cent Deseeded weight			Grade.	Grader's Remarks.
				Line.	Tow.	Total.		
1. No zinc (control)	30	Greenish yellow. Yellow at butts. Fine diameter. Slight rust present. Less mature than 2. Difficult to deseed.	23·3	22·1	6·4	28·5	C	
2. Zinc.....	33	Greenish yellow. Yellow at butts. Fine diameter, slight rust. Some brownish straws.	21·2	25·9	3·8	29·7	E	Very good l a

FACTORS ASSOCIATED WITH ZINC DEFICIENCY.

As a result of observations made since zinc dieback was first noticed, a number of factors which contribute to the occurrence of this disorder have been noted.

1. Perhaps the most obvious of these has been excessive soil moisture as in all cases the severity of the symptoms seemed to be in direct proportion to the amount of waterlogging.

2. Length of day also seems to be involved inasmuch as side growth, or growth recommencement of not too badly damaged tips of the main stems, takes place as the days commence to lengthen in August. This even occurs in soil which is still waterlogged. The above photographs, some of which show this regrowth, were taken in mid-August.

3. The types of soil where dieback was most severe were described by Mr. G. H. Burvill as grey to grey brown gritty or gravelly loamy sands to sandy loams with clay at a depth of one to two feet. The deeper reddish loams carried flax that was practically free from dieback.

4. Superphosphate applications have been observed to affect the incidence of dieback. A striking case was noted where a grower had sown a drill strip of flax for a distance of a few chains without superphosphate. Within this strip the plants were free from dieback and stood out in contrast to the severely affected plants on either side which had received the usual dressing of superphosphate.

A detailed investigation of the problem of zinc nutrition of flax is being conducted by the Plant Nutrition Branch of this department.

LITERATURE CITED.

Adam, D. B., & Piper, C. S., 1944. "The Use of Zinc for Flax." S. Aust. Jour. Agric. XLVII, pp. 422-426.

Millikan, C. R., 1946. "Zinc Deficiency in Flax." Vict. Jour. Agric. 44, pp. 69-72.

Tisdall, M., June, 1947. "The Processing of Flax from the Muradup Zinc Manurial Trial." (Project F.21—Progress Report, No. 59—Expt. F.21-y-3.)

PASTURE COMPETITIONS, 1947-48.

AUSTRALIAN DAIRY PRODUCE BOARD PASTURE IMPROVEMENT COMMITTEE.

THE above Committee organised pasture competitions throughout Western Australia with the object of encouraging attention to the development of pastures on dairy farms. In order to ensure that competitions between farm and farm would be on some comparable basis, the State was divided into zones as follows:—

Zone 1—Coastal Area (Muchea to Ludlow River).
Zone 2—Busselton-Augusta.
Zone 3—Donnybrook-Bridgetown.
Zone 4—Manjimup-Pemberton-Northcliffe.
Zone 5—Walpole-Denmark-Albany-Mt. Barker.

In Zone 1, in which is included the irrigation areas, two competitions were conducted—one for irrigated lands and one for dry lands.

It was stipulated that the area entered was to be not less than one acre.

The following prizes were offered by the Committee in each zone:—

First place	5 guineas.
Second place	3 guineas.
Third place	2 guineas.

The scales of points adopted for judging were as follow:—

(a) Pastures on Non-irrigated Lands—	Points.
General appearance, density, evenness of sward ..	40
Botanical composition	20
Freedom from weeds and insect pests	15
Fertilisation	10
Cultural treatment	15
	100

(b) Pastures on Irrigated Lands—	
General appearance, density and evenness of sward ..	40
Botanical composition	20
Freedom from weeds and insect pests	15
Drainage and irrigation	15
Fertilisation and cultural treatment	10
	100

The competitions were conducted under the general direction of the Superintendent of Dairying, Department of Agriculture, whilst judging was carried out by a number of officers in the Dairy Branch.

The results in each zone are as follow:—

Zone 1.

A.—Irrigated Pasture.

Judges: H. G. Elliott and N. R. McKeown.

There were 18 entries, which were judged during October, 1947, and again in February, 1948. Points were allotted at each inspection and the result of both is included in the following table.

DAIRY PRODUCTS MARKETING BOARD PASTURE COMPETITION, 1947–48.

IRRIGATED SECTION—ZONE 1.

Points Allotment—Combined from both Inspections.

Competitor.	General Appearance Density and Evenness.	Botanical Composition.	Freedom from Weeds and Insect Pests.	Drainage and Irrigation.	Fertilisation and Cultural Treatment.	Average Total.
J. Salerian, No. 1., Waroona .	37	17	17½	13½	10	91
J. Woodier, Harvey	36½	18	13½	14½	7	89½
J. Salerian, No. 2., Waroona ...	36½	15	13½	13½	10	88½
J. Hanks, Harvey	35½	17½	13½	14½	6½	87½
L. Hooker, No. 2., Harvey . .	34½	16	13	14	6	
F. Craig, Dardanup .	34	16	13	13	6	82
R. Hanks, Harvey . .	33½	14½	12½	14½	6½	81½
V. Wright, Brunswick	34½	15½	12	12½	6½	81
L. Hooker, No. 1., Harvey . ..	31½	15½	12½	13½	6	80½
H. McNeil, Waroona	32½	13	13	14	6½	79
L. Damiani, Waterloo	31	15½	12½	13	6	78
Miss Doman, Waroona	31½	12½	12	14½	6½	77
P. Edwards, Waterloo	31	15	13	12	5½	76½
M. Morellini, Dardanup	30	16½	11½	12½	5	75½
F. Reeve, Brunswick	28½	16½	11	13½	5	74½
R. Palmer, Harvey .	27½	12	12	12½	5½	69½
V. Robinson, Burekup	25	13	11½	13½	5½	68½
D. Campbell, Brunswick	27½	12	9½	12	5½	66½

The prize-winners were:—

First—Mr. J. Salerian, No. 1 entry, Waroona.

Second—Mr. J. Woodier, Harvey.

Mr. Salerian is to be congratulated on his entries and the excellent way in which he rotates his grazing, fertilises, tops and renovates his pastures. The intervals between grazings vary according to the season and pasture recovery from 14 to 24 days.

Two applications of superphosphate with a maximum of 4 cwt. are given annually. Severe pasture renovation with discs and harrows is carried out in the early winter, while topping and pasture harrowing are also carried out as a routine practice when required.

General Information.

1. Throughout the whole of the irrigation area most farmers are conscious of the value of using certified seed in the mixtures sown.

2. The major species sown are white clover as the dominant legume in association with all or some of the following grasses:—Perennial ryegrass, Cocksfoot and Paspalum. In some instances, a small quantity of Strawberry Clover and/or Lotus Major is added.

3. On most areas judged, couch grass is present and in many there is some encroachment of annual grasses and clovers, more particularly Spear and Wimmera ryegrass, sub and Drooping Flowered and suckling clovers.

4. Weeds.—On recently sown areas, particularly autumn sown fields, Cape weed has a tendency to dominate in the first year. The major weed was Umbrella grass (Cyprus sp.) in the Brunswick-Roelands district. This weed is becoming very serious in this district.

Sedges, docks, sorrel and flat weed occur in certain areas, and very little is being done by farmers to control these weeds.

5. Although not recommended for the irrigation areas, on quite a few fields kikuyu was observed. This grass, unless very rigorously managed, mats and becomes absolutely dominant, and finally becomes low in production.

6. In many cases, land was sown to pasture without sufficient preparation.

7. Management of the irrigated pastures as a general rule was not good. Very little renovation is carried out—in some instances topping is not done or only once in the season, and grazing is very haphazard. Heavy autumn and winter grazing, light spring grazing and reasonable summer grazing, is the general rule. The practice of leaving irrigated fields for hay and cutting late in spring is not a good one, as it seriously retards the regrowth of white clover and sometimes reduces the stand of it and Cocksfoot, allowing couch and paspalum to take charge.

8. As a general rule, superphosphate is applied twice per annum, in the early autumn and spring, up to 5 cwt. being applied annually.

9. Irrigation.—Nearly all the pastures judged in the competition had been laid down in long strips or borders on graded land. In one or two instances, the pastures were watered by the furrow method on land not well graded.

10. Drainage.—During the first inspection in the latter part of the winter, it was noted that quite a number of farmers had not cleaned out their drains to enable the free movement of water. Consequently, in certain sections of the fields, some waterlogging had occurred and in odd places water had lain on the area for considerable periods, thereby reducing the stand of ryegrass, white clover and cocksfoot.

In the second inspection, these areas were very noticeable, as they carried staggy paspalum only. Where grading had taken place with land prior to sowing down for irrigation, much better control of winter water had taken place.

11. Grazing.—Much damage with respect to subsequent carrying capacity is done on the average irrigation pastures inspected by over-grazing in the late autumn and winter months.

This over-grazing retards the recovery of perennial ryegrass, cocksfoot and white clover.

During the late spring months, under-grazing is the general rule, with a consequence that a heavy mat of pasture is produced which is not effectively utilised, as much deterioration occurs to the material produced, which is semi-rotted near the ground level.

Extreme care should be taken with grazing from the beginning of April onwards, as over-grazing between April and August will cause not only deterioration of the pasture species, but also cause weeds to gain a foot-hold over the bareness which occurs through over-grazing.

Grazing, during the spring and early summer months, should be controlled sufficiently well to prevent excess of bulk being produced during those months. The time between grazing should vary according to seasons and rate of recovery, and the periods might vary from 14 days when maximum growth is taking place, to 30-35 days when the pastures are at their last growing stage.

Zone 1.

B.—Dry Land (Non-irrigated) Pasture.

Judges: H. G. Elliott and N. R. McKeown.

	General Appearance.	Botanical Composition.	Freedom from Weeds and Insects.	Fertilisation.	Cultivation	Total.
	40	20	15	10	15	100
J. Salerian, Waroona	38	17	13	10	15	93
R. McNeil, Waroona	39	18	13	10	12	92
J. Lowe, Harvey ...	35	13	13	10	12	83
C. Piggott, Brunswick	35	12	12	10	13	82
F. W. Leaver, Byford, (1)	30	14	11	10	10	75
C. W. Ward, Waroona	35	15	10	9	5	74
C. Piggott, Brunswick (2)	26	12	12	10	13	73
R. Palmer, Harvey ...	30	13	13	9	5	70
F.W. Leaver, Byford, (2)	28	11	9	10	10	68
E. W. Jones, Harvey....	30	10	14	8	....	62
McLeod, Waroona ...	25	13	10	9	....	52

The winning and runner-up entries submitted by Messrs. Salerian and McNeil, both of Waroona, were particularly good production pastures, and at the time of judging were very well presented, as both were a little over a week since last grazed. Although Mr. McNeil gained higher points in general appearance and botanical composition for his pasture, Mr. Salerian gained maximum points for cultivation and renovation.

Hereunder are the comments on the individual plots entered for this competition:—

J. Salerian, Waroona (93 points).

An area of three acres in a five-acre field was judged. The pasture was sown down in 1942 with a mixture consisting of sub-clover, mid-season phalaris tuberosa and a little perennial ryegrass, and since planting some encroachment over the whole area has occurred with paspalum. Prior to planting, the whole area had grown two crops of potatoes and one of oats.

At the time of inspection, the pasture was approximately 6in. high, even, vigorous with excellent colour, and had an excellent proportion of grasses, i.e., phalaris tuberosa. perennial ryegrass and paspalum, with mid-season sub-clover. Other minor clovers and grasses were present in odd places.

The whole area receives one bag super. in the autumn and one bag in the spring. Renovation by using a sunprong and pasture harrows is carried out annually in early June and pasture harrows are used during the early spring. No weeds were present, and slight damage occurred from Red Mite and Lucerne Flea.

R. McNeil, Waroona (92 points).

This pasture consisted of paspalum, perennial and Wimmera ryegrass and sub-clover, with a couch base. Two acres of a larger field were selected. The pasture was uniform in height to 6in., vigorous in growth and of excellent colour. Red Mite was causing some damage, and a little Cape weed occurred in isolated spots. Heavy fertilisation up to three bags super. is given annually, and the whole area had been seeded down following a potato crop.

J. Lowe, Harvey (83 points).

This was a particularly vigorous pasture, consisting of white-seeded sub-clover with Wimmera ryegrass. Sub-clover dominated the sward. Super at rate of 2½ cwt. was applied in the autumn.

C. Piggott, Brunswick (1) (82 points).

The area of the paddock was approximately eight acres; carried a heavy stand of "Yarloop" white-seeded subterranean clover with a small quantity of perennial ryegrass, plus some minor species such as lotus and annual grasses.

The soil consisted of wet, puggy clay and the paddock had been closed to stock since the end of June. The clover generally was very heavy and it was estimated that the paddock would cut in the vicinity of three tons of hay per acre. The area had been established approximately three years, and topdressed annually with one bag of superphosphate in the autumn and an additional one cwt. in the spring.

Annual renovation was carried out in the late autumn, using a bush-bog cultivator followed by light harrows.

F. W. Leaver, Byford (1) (75 points).

This pasture consisted of phalaris and subterranean clover which contained many other annual grasses and clover species. Unfortunately, the subterranean clover had not re-generated well and gave an uneven stand.

Over most of the area the phalaris tuberosa was doing well, but was concentrated more towards the furrows than on the main lands. Generally, the pasture was not vigorous, although 2 cwt. of superphosphate had been given annually.

There was a considerable amount of Red Mite and Lucerne Flea and the main weeds consisted of odd docks and flat weed.

C. W. Ward, Waroona (74 points).

Paddock inspected for the competition consisted of a mixture of paspalum, Wimmera ryegrass, subterranean clover with a little drooping-flowered clover, lotus hispidus and annual grasses.

The area had not been grazed for approximately five weeks, and was relatively uniform. The main weeds consisted of Iris, docks and flat weeds.

The area had been topdressed with approximately 2 cwt. of superphosphate in the autumn but had not received any cultural treatment.

C. Piggott, Brunswick (2) (73 points).

The area consisted of approximately four acres, which had been established four years.

This area consisted of "Yarloop" white-seeded subterranean clover with a little perennial ryegrass and odd annual grasses.

Apart from fertilisation and cultivation, which were the same, some winter grazing had been tried out on the area and had proved unsuccessful, the sward being badly damaged by poaching and the general appearance and condition of the clover being markedly inferior to entry No. (1).

R. Palmer, Harvey (70 points).

The area of approximately eight acres consisted mainly of mid-season subterranean clover, with a little ryegrass and a base of couch.

The main weeds were odd docks and flat weed, and quite a considerable amount of damage had been done in the earlier periods to the subterranean clover by Red Mite and Lucerne Flea. The area had not been renovated, but was fertilised at the rate of one bag superphosphate per acre.

F. W. Leaver, Byford (2) (68 points).

The area of 10 acres, consisting of perennial ryegrass and subterranean clover, was not a particularly uniform stand, as the association of ryegrass and clover was poor in sections. The recovery of mid-season subterranean clover was not good after establishment of ryegrass. The main weeds consisted of flat weed and odd docks. The area had been fertilised at the rate of 2 cwt. superphosphate per acre.

E. W. Jones, Harvey (62 points).

Approximately 10 acres of white-seeded subterranean clover.

Practically a pure stand, the only adulteration being of odd plants of drooping-flowered clover. No grass had yet been introduced and the stand was only two years old. The pasture had been established on an area comprised of very heavy wet clayey soil which tended to become extremely waterlogged in the wintertime. Annual dressing of 2 cwt. per acre had been given.

Mr. McLeod, Waroona (52 points).

Area consisted of approximately four acres of subterranean clover and ryegrass, with a little drooping-flowered clover and other annual grass species. Sward was most uneven and had not been grazed for approximately six weeks.

The clover was showing the effects of Red Mite and Lucerne Flea and the main weeds were rushes and docks. The area had been fertilised annually at the rate of one bag of superphosphate, no renovation having been given during period since establishment.

ZONE 2.

BUSSELTON—AUGUSTA.

Judges: A. L. Hamilton, Dairy Adviser, Busselton, and V. B. Monti, Dairy Supervisor, Margaret River.

The details of the points awarded are as follows:—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insect Pests.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
G. M. Smith, Jindong	35	18	12	10	15	90
D. O. Briggs, Metricup	35	15	8	10	15	83
F. A. Wilkinson, Jindong	30	15	10	10	15	80
J. B. Clark, Yelverton	30	15	8	10	15	78
G. Crooke, Cowaramup	30	18	5	8	7½	68½

The following comments were submitted by the judges:—

G. M. Smith, Jindong (90 points).

This plot was originally sown as a trial area of phalaris tuberosa three years ago. The soil is of grey sandy loam which previously grew jarrah and marri at one end, fading into rather wet country support—some paper-bark ti tree at the other end. The phalaris had made excellent growth, with a good ground cover of sub-clover. In addition, perennial ryegrass and a small proportion of Yorkshire fog was making good growth. The plot received copper sulphate at the rate of 10 lbs. and super. at the rate of approximately 150 lbs., in the first year of establishment, and 6 lbs. copper and the same rate of super. in the second year. Very little weed growth was to be seen, but a light infestation of red-legged earth mite was apparent.

D. O. Briggs, Metricup (83 points).

A section of a pasture paddock was selected as the entry on this property. The soil was a grey sandy nature, previously supporting marri and jarrah. The selected area had no special treatment during the year, but had received an average dressing of super. and copper sulphate in common with the other pasture paddocks on the farm. This paddock was cut for hay two years ago.

The botanical composition comprised sub-clover, lotus major, paspalum, and perennial ryegrass, with some patches of kikuyu. A factor which reduced the points allocated for this plot was a scattered infestation of dock, and the presence of red-legged earth mite, which had caused considerable damage.

F. A. Wilkinson, Jindong (80 points).

This area was chosen by Mr. Wilkinson as an example of pasture improvement. Three years ago the paddock was covered with spear and silver grass, and quite void of clovers. Renovation comprised cultivation with discs and sowing sub-clover, with the application of one bag of super. and 20 lbs. copper sulphate per acre. In the second year the paddock was again disked and topdressed with superphosphate.

The growth of sub-clover was particularly good, but from the permanent pasture point of view, the plot lacked the balance which would be provided with the incorporation of a good grass. Red-legged earth mite damage was fairly severe.

The soil type was a red brown sandy loam, previously supporting jarrah and marri.

J. B. Clark, Yelverton (78 points).

The plot selected comprised portion of an oat crop sown for hay, as the permanent pasture on the farm had not come up to expectations. The ground cover consisted of sub-clover, lotus species, hop clover, and the crop generally was free from pests and weeds. This area did not compare with the other entries, however, from the permanent pasture point of view.

G. Crooke, Cowaramup.

The plot is the bull paddock and is founded on a grey sandy loam. The coverage was heavy but, as will be seen from the botanical composition and the light grazing, the height of the sward was uneven. The composition of the plot was as follows, in order of dominancy:—Sub-clover, ryegrass, paspalum, fog grass, lotus major and odd plants of white Dutch. There was no evidence of parasitism, but docks were present in fair numbers. Fertilisation consisted of one application a year of two cwt. of superphosphate, with copper every fourth year. The plot was laid down 12 years ago and has only been pasture harrowed since.

Zone 3.

Donnybrook-Bridgetown.

Judge: K. W. Simes, Dairy Instructor, Bridgetown.

The point allotments made by the judge are as under:—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insect Pests.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
S. C. Maidment, (1), Balingup	34	15	12	9	15	85
J. V. Dunnett, Nannup	34	15	12	7	8	76
S. C. Maidment, (3), Balingup	31	12	13	9	10	75
S. C. Maidment, (2), Balingup	28	13	13	6	12	72
K. Slattery, (1), Winnijup	35	16	10	7	....	68
K. Slattery, (2), Winnijup	32	17	12	7	....	68
Moyes & Son, Bridgetown	28	14	13	10	....	65
R. Brazier, Kirup ..	31	15	12	7		65
G. White, (1), Balingup	30	15	12	7	...	64
G. White, (3), Balingup	29	16	11	7	....	63
J. Gale, E. Nannup ...	30	8	10	6	8	62
J. Miller, (1) Nannup....	28	17	10	6	....	61
J. Dowrick, Mallalyup	30	10	12	8	..	60
J. Miller, (2), Nannup	29	15	10	6	....	60
J. Pearson, E. Nannup	27	12	10	7	.	56
P. Plozza, Cundinup...	30	8	10	6	....	54
G. White, (2), Balingup	27	12	5	10	...	54
J. & C. Williams, Bridgetown	25	11	10	7	.	53

Some details of each entry are given below.

S. C. Maidment, Balingup, No. 1 Plot (See report 105/44, 12/11/47).

No. 2 Plot.—A kikuyu cover which was sown from runners planted by hand in June, 1940. The rows were seven feet apart. The area was sunpronged in the February of 1947, treated with 150 lbs. super., and further chain harrowed in the months of June, July, August and October. The sward was uneven, inclined to be patchy and showed the effects of frost. Odd plants of dock were noticed.

No. 3 Plot.—Another kikuyu sward on semi-moist land. This entry was more even, the clover was inclined to show some unevenness in distribution, but nevertheless the general appearance of the cover was most pleasing. Further comments are contained in report of 12/11/47.

J. V. Dunnett, Nannup.

The plot comprised phalaris, sub-clover, a little perennial rye and a sprinkling of the more inferior grasses and clovers. The cover was very free of insect pests, appeared very even, was a nice colour and well conditioned. Further comments in report of 12/11/47.

K. Slattery, Winnijup.

No. 1 Plot.—The acre was sown to P. tuberosa, lucerne and sub-clover in the autumn of 1939; since then the only treatment has been one bag of super., applied in the autumn of each season. The pasture carried a heavy bulk of feed which, owing to the very wet season, was weighed down with the moisture, causing the lower portions of the plants to form a mat on the ground and rot. These conditions were ideal for the red mite and lucerne flea, evidence of their attacks being very much to the fore in the general appearance. The lucerne appeared to have died out over a period of years and weed infestation was fairly heavy.

No. 2 Plot.—The area was ploughed and sown to lucerne in 1939, since then the plants have been reduced in numbers and the P. tuberosa from the adjoining area has encroached to become the dominant pasture plant. The cover was uneven, carried a considerable amount of weed, and showed the ravages of insects.

Moyes and Son, Bridgetown.

An acre was selected in a field which had been sown to clovers, Y. fog, paspalum and perennial rye some 20 years ago, and which served to carry the stock until well into the summer months. Where the soil was damp and the moisture close to the surface, the pasture was reasonably dense and even, retaining a growth akin to the original sowing. Moving over the area it was seen that the fog grass was about the only plant to persist. Weeds, too, occupied a fair percentage of the cover. The treatment of the pasture was with super., one bag in the early winter and another in the early spring.

R. Brazier, Kirup.

A semi-moist area which had been rejuvenated in the spring of 1945 with sowings of perennial rye, mid and Tallarook clover, Albino and N.Z. wild white clovers, super. at the rate of one bag per acre was broadcast at the time of sowing, and treated similarly each season. The cover appeared nicely conditioned, was well grown and fairly free of insects; unfortunately it was very patchy and carried too much weed.

G. White, Balingup.

No. 1 Plot.—The area sown in 1938 showed to contain approximately one-third P. tuberosa, one-third sub-clover and the balance weed. The cover was uneven, not very dense, and in some places inclined to be rank. Treatment in past years has been one bag of super. applied in the early autumn.

No. 2 Plot.—Tallarook clover, which was sown in 1945. The area was previously put down to P. tuberosa, but appeared not to have "taken." The clover showed to advantage, was very dense and fairly even over the entire area. It was fairly free of weeds and insects, but the pasture was over-run with fern growth. The treatment was one bag of super. in the early autumn with a like amount applied in the early spring.

G. White, Balingup.

No. 3 Plot.—Sown on some early developed semi-moist land. The pasture in the main consisted of perennial ryegrass, kikuyu, sub-clover with a sprinkling of the more inferior types of clover and grasses. The area received super. at the rate of one bag per acre in the early autumn. The area was patchy, somewhat uneven and carried a large percentage of weed, principally dock and wild turnip.

J. Gale, E. Nannup.

Entered an acre of sub-clover. As an experiment, one corner of the area had been treated with copper and the results were self evident in the improved growth noticed in that position. Super. at the rate of 1¼ bags per acre was applied in two applications during the year; the area had also been harrowed each year. The pasture was uneven and carried too much weed.

J. Miller, Nannup.

No. 1 Plot.—The area of semi-moist land was developed in 1941 and sown to clover, water couch, kikuyu, lotus major and paspalum. The sward was fairly dense, but too uneven, with water holes carrying light rush growth. The distribution of the mixture, too, was uneven, and the grasses did not appear well developed. The only treatment was one bag of super. per acre. Had this area been worked and renovated, it would have presented a more pleasing picture.

No. 2 Plot.—Kikuyu was the main pasture, with a sprinkling of paspalum and couch. The cover was most uneven, patchy, and showed too much weed in the form of dock. One bag of super. per acre.

J. Dowrick, Mullalyup.

Showed an area of one acre which was sown to mid season sub about eight years ago. Treatment over recent years—one bag of super. applied in the autumn, plus copper (total copper now amounts to 25 lb. per annum). The area was rolled for seed in 1944 and 1945. The cover was fairly even but lacked density. Rye was included in the original sowing, but it did not persist. Some weed was noticeable.

J. Pearson, E. Nannup.

A very old pasture, comprising couch with a sprinkling of paspalum, clover and fog grass. The whole was very uneven and lacked density. Super—¾ bag early autumn and ½ bag in the spring.

P. Plozza, Cundinup.

A sub-clover pasture showing 50 per cent. native grasses and weed. Very poor.

J. & C. Williams, Bridgetown.

An old area that had been sown to P. tuberosa a considerable number of years. The phalaris appears to have died out, as only odd plants were to be seen here and there. Rye-grass was noticed in odd places. The cover was very thin and lacked density. The area had been treated with one bag of super. per acre in one application.

Zone 4.

Manjimup-Pemberton-Northcliffe.

Judge: J. T. M. McNally, Dairy Adviser, Manjimup.

The following table sets out the points awarded to each entry:—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insects.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
J. Bashford, Northcliffe	37	18	12	8	14	89
A. J. S. Angel, Jardee	37	18	12	8	13	88
W. Beard, Manjimup	35	17	12	9	13	86
J. O. Shepherd, Appadene	32	18	12	7	13	82
J. Heathcote, Northcliffe	30	18	9	8	10	75
J. T. Downes, Northcliffe	26	16	8	7	10	67
J. J. Littlefair, Pemberton	25	10	8	6	10	59

The following comments were submitted by the judge:—

J Bashford, Northcliffe.

Entry 15 acres of flat country—well-drained. General appearance was very good and indications are for a very heavy crop of hay. Pastures consisted of a very even mixture of perennial rye-grass, paspalum, droop-head, white Dutch and subterranean clovers, Lotus major and kikuyu with some yellow suckling clover and Yorkshire Fog. Weed growth was light, comprising docks and sorrell and there was some mite and flea present.

Fertilisation comprised 1 cwt. super. in March, 1 cwt. in August. Copper was previously applied at rate of 10 lb. per acre. No farm yard manure was carted, but droppings were harrowed in every six weeks during season.

A. J. S. Angel, Jardee.

Moist flat land, totally cleared. General appearance was good, grazing had been carried out at various intervals during the season and on inspection pasture was a couple of inches long, fairly even and dense. Pasture species comprised paspalum, white Dutch clover, subterranean clover, ryegrass and Kikuyu with a few minor species. Rye and kikuyu were not well distributed. Weed growth was sparse, but red mite were present in varying quantities. Pasture harrows were used twice during the growing period.

Fertilsation comprised 1½ cwt. super. in autumn and 1½ cwt. in spring. No farm yard manure was used other than droppings direct on the pastures.

W. Beard, Manjimup.

Land, a gentle slope originally timbered with karri, jarrah and red gum. Area totally cleared. Pasture harrows used frequently. Cutting has been carried out every year over 15 years and now appears to be affecting the colour and strength of the pasture. Pasture species comprised kikuyu, subterranean, strawberry, hop, suckling and drooping-flowered clovers, sweet vernal, rye-grass, paspalum, trefoil, Yorkshire fog and a number of minor varieties. Yorkshire fog is fairly heavy, other species are not as well mixed as in former years. Weed growth is sparse but red mite was prevalent.

Fertilisation—one bag of super. in the autumn. Farm yard manure is spread over each paddock once in every three years.

J. O. Shepherd, Appadene.

This entry was the plot of Phalaris tuberosa planted during 1945. Pasture harrows were used twice during the season. The general appearance was patchy, colour varied from dark to light green. Rabbits had attacked parts. Pasture species comprised Phalaris tuberosa, subterranean clover, lotus rye and silver grasses, wild oats and a few minor species. The general distribution of species was erratic and on some areas the density was patchy. Weed growth was light. Red mite were present.

Fertilisation.—No superphosphate was applied this season, but heavy dressings were given during the last few seasons. In 1947, 16 lb. sulphate copper was applied. No cow manure applied other than droppings during grazing.

J. T. Downes, Northcliffe.

A moist slope, originally carrying mixed timber and undergrowth. General appearance was patchy, suggesting that the use of pasture harrows would be well worth while. Pastures comprised paspalum, drooping-flowered clover, subterranean clover, kikuyu, lotus major, rye-grass and suckling clover. These were not well-mixed and numbers of bare patches were visible throughout the paddock. Weed growth was not heavy. Red mite and lucerne flea were bad.

Fertilisation consisted of one bag of superphosphate, plus five lb. of copper per acre, sown in the autumn. No farm yard manure other than droppings was applied.

J. Heathcote, Northcliffe.

The area submitted was the Phalaris rye-grass plot of the former competition. The present pasture species comprise Phalaris, rye-grass, cocksfoot, subterranean and suckling clovers but the distribution of the species is patchy.

Weed growth is not heavy and is made up of a few docks and some sorrel. Lucerne flea is exceptionally bad and red mite is present.

Fertilisation consisted of one bag superphosphate per acre, autumn application. No farm yard manure, other than droppings during grazing was applied. Pasture harrows are not used.

J. J. Littlefair, Pemberton.

The plot was on a karri slope and had been cultivated, harrowed and planted in May, with Wimmera rye-grass and subterranean clover. The density is very light, irregular and poor in appearance. Some lotus is mixed with the rye-grass and clover. Docks and bracken are very bad. There are infestations of lucerne flea and red mite.

Fertilisation was one bag superphosphate in the autumn and one bag in the spring. No farmyard manure other than droppings during grazing was applied. No pasture harrowing took place.

ZONE 5.

WALPOLE-DENMARK-ALBANY-MOUNT BARKER.

Judge.—C. W. Tobin, Dairy Instructor, Denmark.

The Judge's decision on the scale of points laid down is shown in the following table :—

Competitor.	General Appearance.	Botanical Composition.	Freedom from Weeds and Insects.	Fertilisation.	Cultivation.	Total.
	40	20	15	10	15	100
F. Pease, Torbay	37	18	13	9	14	91
R. B. Wilkinson, King River	35	17	12	10	14	88
J. Wilkinson, Kronkup	35	18	11	8	14	86

Mr. Tobin has made the following report:—

F. Pease, Torbay.

Dense perennial and Wimmera rye-grass and subterranean clover. Little paspalum and drooping flowered clover. Approximate proportion 60 per cent. grasses, 40 per cent. clovers. Very healthy, clean, well-managed pasture on 11-year jarrah-red gum soil. General absence of weeds or poor type grasses most striking. One or two docks only.

Fertiliser: One bag super. per acre.

R. B. Wilkinson, King River.

Good cover strawberry clover, lotus major, little subterranean clover, with well-established paspalum and Yorkshire fog. Little perennial rye-grass, sweet vernal and lamb's tongue. Good mixture of late varieties. Sward slightly uneven and carrying few weeds. Pasture on moist 13-year bottlebrush country. Well managed.

Fertiliser: 1½ bags super. per acre.

Note.—This crop is not so well advanced because moist land growth is generally later this year. It will probably be better early January.

J. Wilkinson, Kronkup.

Even cover of Wimmera and perennial rye-grass and subterranean clover. Little Yorkshire fog, lotus major and minor, with some kikuyu at one end. Well-balanced pasture. Density is weak, probably due to management as a sheep grazing proposition. May be improved with heavier superphosphate dressing. Little silver grass, sorrel and flatweed. Land is very old, semi-swamp.

Fertiliser: Ninety lb. potato manure per acre.

The entries are considered to be the three best-balanced pastures seen in the district this season. A few points were lost for density and evenness by the second and third placed entries, but this should not discourage the farmers concerned, as it is believed this can be remedied by closer attention to fertilisation and management with regard to stocking.

Weed growth was responsible for the loss of a few points and this, too, can be obviated without very much effort. Where there are only a few large weeds, such as dock, they should be pulled before they seed. The smaller weeds appear to be smothered out by a dense cover of clover and grasses.

The winning entry is a good example of well-balanced, clean, well-managed pasture and is a credit to the owner.

FRUIT AND VEGETABLE SHIPMENTS TO SINGAPORE.

A Report By H. R. POWEL, Superintendent of Horticulture.

PRIMARILY at the request of the Central Citrus Council, arrangements were made for me to visit Singapore for the purpose of inquiring into various phases of the fruit export trade from this State. The Department of Commerce and Agriculture which administers the Exports (Fresh Fruit) Regulations agreed to equally share the expenses incurred, provided that the inquiries were made on an Australian basis and that the reports would be available to all States. This arrangement greatly facilitated my investigations as every possible assistance was given to me by the Australian Trade Commissioner in Singapore, Mr. J. Payne.

I left Fremantle on the M.V. "Charon" on the 5th November, 1947, and returned to Fremantle on the M.V. "Gorgon" on the 13th December, 1947.

The purpose of the visit was, firstly to obtain first hand knowledge of the conditions under which the non-frigerated cargoes of fruit travel, secondly, to ascertain the condition on arrival of shipments from Australia, thirdly, to obtain information as to the quality standards observed by other exporting countries on this market and, lastly, by observing the difficulties under which Australian exporters are placed to suggest possible improvements.

Reports have been made on certain fruits and vegetables which are included in this article and it is hoped that the others will be completed in the near future.

Acknowledgments to those persons who assisted me will be made when the whole report is completed, but I would at this stage like to express my thanks to Mr. L. H. Lewington, the Shipping Manager of Dalgety & Co. the Agents of the Blue Funnell Line, who made the voyage to Singapore with me and to Capt. Marriott of the M.V "Charon" and his officers, particularly Mr. Vaughan, the First Officer. Through their co-operation I was able to record particular weather data at regular times each day and free access to the fruit carried on deck and the lower 'tween deck was always permitted.

GRAPES.

Inquiries concerning grapes were made with importers and agents in the course of specific inquiries associated with other fruit and vegetables.

The oustanding impression obtained was the popularity of the green skinned variety Ohanez, and to a somewhat lesser extent Bridal's supplied by Western Australian exporters. Together with Granny Smith apples, these fruits are by far the most popular Australian fruits in Singapore.

Dealers stated that the Chinese, particularly, wanted green varieties and that the colour itself was important to them. A number of inquiries were made as to why such an interest was shown in the colour, but the nearest I could get to it was that green means a 'primo stage' and thus in some way is related to condition and to something that will keep.

During my visit, American Ohanez, known as Almerias were being sold in the vicinity of $45 (£6 10s. 0d.) a box. These boxes contain 32 lbs. net. I was told that the wealthy Chinese buy them and are not greatly concerned with the cost. The coloured varieties are largely consumed by the European population and the retail price is very much lower.

Ohanez grapes are often cool stored for considerable periods after they have been unloaded. One instance was mentioned to me by a dealer who cool stored his grapes last year until December and then sold them at the handsome price of $65 (£9) a box. I understand that it is a common practice to cool store this variety up to the end of September each year.

Very little interest was displayed in the coloured varieties of grapes, although considerable quantities from Western Australia are shipped to Singapore each year. Some interest was shown in Canon Halls and I raised the question whether or not, in view of the limited supplies of green grapes on the market in January, a trial shipment of grapes not up to the required standard as to sweetness, would be warranted. This suggestion received favourable encouragement and on my return I arranged through the Export Grape Advisory Committee, for five cases with a Beaume reading of 8.2° instead of 9° prescribed in the Regulations to be sent on the M.V. "Gorgon" which left Fremantle on January, 21. I have since received a very favourable reply from the Australian Trade Commissioner to the effect that the grapes had arrived in very good condition and that their market value was in the region of $23 (£3) a case.

Unfortunately most of the grape shipments last year were sent non-refrigerated and I was told that waste was particularly high with such varieties as Red Prince, Red Emperor, and more particularly so with Flame Tokay. It is felt that the restrictions by regulation which are pending at this end, will do

much to reduce these losses. I received no complaints with regard to the Ohanez but it was emphasised that the fruit should be always sent in refrigerated chambers. I was able to explain that this was not always possible, but as soon as conditions improved it was the objective of shippers to send these grapes only under refrigerated conditions.

I raised the question of packing materials and inquired whether or not sawdust or granulated wood as used by the Americans, would be acceptable in place of the granulated cork; I was told in every instance that they preferred the granulated cork. It can be mentioned, however, that the American grapes packed in granulated wood arrived in a sound condition but when the berries were eaten fresh from the box, there was a strong turpentine taste associated with them.

I endeavoured to make some inquiries as to the extent of the market, but could not get very far. The nearest approach was 6,000 cases a month, which could perhaps be increased by 50 to 100 per cent.

During my stay over a period of approximately three weeks, I was able to see grapes from America and Holland and the following notes were made at the time:—

A. AMERICAN.

(a) *Fitraco Brand.*—Emperors.—On the label it was stated that the grapes were the product of the United States of America and specially packed for the Fidelity Trading Company incorporated in San Francisco, California. The minimum net weight of 32 lb. was shown on the label. The label was very attractive and only covered the lower third of the left hand side of the end of the box. The colours used consisted of two shades of blue combined with the colours of a portion of the U.S.A. Flag. Bunches of grapes in yellow, blue and red were also incorporated. The whole package was most attractive. These grapes were selling at between $25 (£3 10s. 0d.) to $26 (£3 13s. 0d.) a box, the condition was very good and the quality excellent. There was no breakdown associated with the berries, the packing material was granulated wood, the bunches were large and open and the berries large and well coloured. The boxes were made of pine, smoothly sawn and the overall measurements were 15 in. by 20in. by 8½ in. The tops, bottoms and sides were ⅜in. in thickness and the end boards ¾in. The boxes were wired with two wires each ½ in. from the ends. Grooves were cut out of the end boards to act as hand grips.

(b) *Blue Port*—Almerias.—This was another attractive label. These grapes were selling in the vicinity of $40 (£5 15s. 0d.) a box for a net minimum weight of 32 lb. Each box was stamped by the inspection services both Federal and State.

(c) *Port to Port*—Emperors.—This brand was also attractive. The fruit was in very good condition and was selling at $18 (£2 10s. 0d.) a box.

(d) *Pacific Prize*—Emperors.—The boxes were stamped "sawdust packed No. 1 grade Emperors".

(e) *Blue Flag*—Almerias.—These grapes were in very good condition, the bunches were open and the berries large and oval in shape, there was no wastage. They were being sold at $45 (£6 10s. 0d.) a box (during the first week in December) as against good quality Emperors selling at $24 (£3 10s. 0d.) a box.

(f) *Oh yes!—We grow the Best!—Californian Grapes*—Emperors.—The brand consisted of two bunches of grapes—one green and the other pink red attractively printed on small labels.

The American grapes, I understand, were shipped as refrigerated cargo from San Francisco to Hong Kong and in some instances, after fresh papers had been made out, were brought to Singapore direct. Other times the fruit was brought as deck cargo and I understand the journey was in some instances of five days duration; I saw a number of packages being unloaded on dealers' premises, each package consisted of six boxes wrapped securely in sea grass matting, sewn and then securely fastened with rope. I understand that no official obstacles are being raised against these importations despite the dollar restrictions.

I could not help noticing how well the labels remained on the American boxes. Very few instances were seen where they were either torn or loosened; several times I endeavoured to prize them off to bring back, but was only successful in two instances, viz; 'Blue Flag' and 'Oh Yes! We grow the best', both products of the Di Giorgio Fruit Corporation, San Francisco.

B. DUTCH GRAPES.

(a) *Famous Junior Brand.*—The varieties were "Blue Alicantes" and "Marocs" the product of hot houses. They were packed in crates three trays to a crate, simply held together by two tie wires. Each tray contained 9 lbs. of grapes without any packing material. Round each tray corrugated cardboard was used rising above the surface of the tray by approximately 3 in. The over-all measurements of the crate were 18 in. by 15½ in. by 12 in. Each tray was approximately 3½ in. wide and rested on four triangular up-rights held together by the two tie wires. The appearance of the grapes was good, particularly so as they still retained their bloom and were in a fresh condition, having arrived from Holland in refrigerated chambers. The flavour, however, was insipid and the colours, blue and black, are not popular in Singapore. I was informed that the c.i.f. cost of these grapes was \$11.50 (£1 12s. 0d.) which included the commission fee of \$1.50 (4s. 6d.). They were being sold at a price ranging from \$9 (£1 7s. 0d.) to \$11 (£1 13s. 0d.) a crate and the retail price in most instances \$1 (3s.) per lb.

(b) *J. Brand.*—Towards the end of my stay in Singapore a further consignment of Dutch grapes arrived, packed very elaborately in crates similar to those mentioned previously. With these grapes, however, the tops of the trays were covered. The covering consisted of a border of coloured paper 3 in. to 4 in. wide made up of green and red stripes with little "j's" in red on the green stripes and in green on the red stripes; the remaining areas were covered with cellophane. Green paper was used to cover the sides of the two lower trays and blue and silver paper for the top tray. On the two lower trays the following information was printed in brown and cream lettering on the cellophane—"The Cream of the Crop," "Weight 9 lbs. net," and "Extra Fancy" at the respective left and right hand corners; in the middle the words "Aristocrat of Fruits" and "Quality De luxe," underneath the words, "Fully Mature Hot House Grapes," and in the lower right hand corner the name of the variety "Alicantes."

The top tray was even more gaily decorated and, in addition to the lettering, illustrations of two bunches of grapes were printed at each side of the cellophane covering. The colour of the paper used on the top was silver and the sides were in silver and blue. Triangular pieces of paper in silver and blue were superimposed on the paper on the sides, attractively printed to the effect that the fruit was the "Cream of the Crop" and a "Glass House Product," together with the symbol of the packer, large "J's."

Some crates of Black Marocs seen here were got up somewhat differently. Each tray was ornamented with blue paper, and cellophane cut to resemble bunches of grapes was superimposed on the paper in the middle of each side. The grapes were selling in the region of $3.50 (10s. 6d.) a tray but the dealer stated that there was very little demand as the variety was not popular owing, principally, to its colour and owing to the fact that American grapes were on the market.

It was obvious that the Dutch exporters had gone to a considerable amount of trouble in making their packs as attractive as possible. From hearsay I obtained the impression that the Dutch authorities were very anxious to build up financial reserves in Singapore.

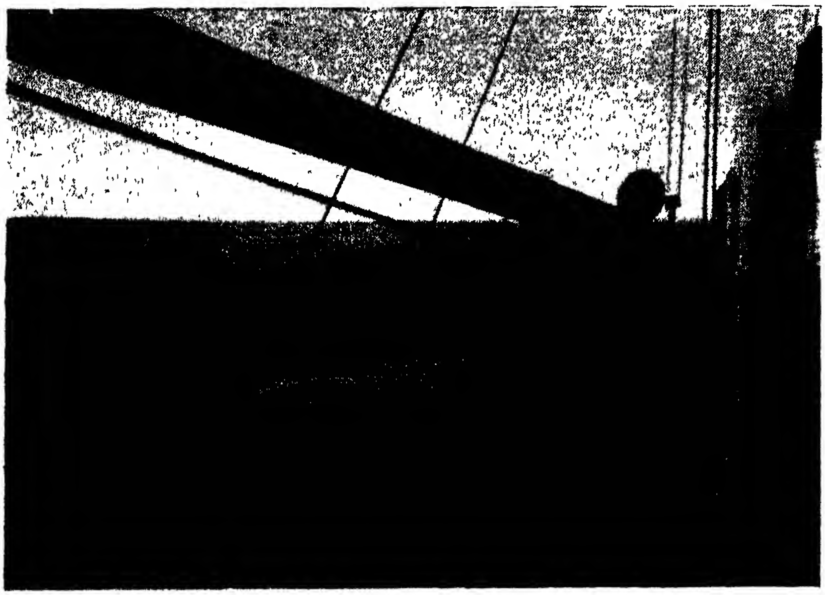


Fig. 1.

Deck stowage on the M.V. Charon. The tarpaulins are drawn up during fine weather as illustrated in Figs. 3 and 4.

(Photo. by H. R. Powell.)

CITRUS FRUITS.

Approximately 3,458 bushels of Valencia oranges and 27 bushels of lemons were loaded as non-refrigerated cargo for Singapore on the M.V. "Charon" at Fremantle on the 5th November, 1947. They were stowed in two stacks of 800 cases, port and starboard respectively, on the forward No. 2 deck and 420 cases port and starboard respectively, on the No. 4 after deck; 1,018 cases of oranges were stowed in the forward lower 'tween cattle deck.

The fruit was supplied by 42 growers from the main citrus producing areas. The largest consignment was 279 cases from a Chittering grower and the smallest was nine cases, also from a Chittering grower; only 13 growers supplied 100 or more cases.

Through pressure of other work it was not possible to personally check the condition of the fruit prior to loading as had been arranged. However, some fruit was examined on board each day until the vessel arrived in Singapore. In addition, data was collected on humidities and temperatures at regular intervals each day and a report will be submitted on this aspect of the investigation. Unfortunately, owing to the wet weather experienced during the last few days prior to berthing a close inspection could not be made as had been arranged with the ship's officers. However, early in the morning of the day the "Charon" arrived in Singapore an examination was made of a number of cases in each stack and it was found that the fruit was generally in good condition, although there was some evidence of mould wastage in many cases; the lemons stowed in the lower tween cattle deck were in an obviously poor condition; there was little difference in condition between the various stacks whether deck or tween deck.

Some pulp temperatures were taken during the voyage and it was noticed that a steady increase occurred en route; the highest tween deck figure recorded was 83° degrees.

The vessel arrived on the morning of the 17th November, 1947. My stay extended to the 5th December, 1947; during this period, approximately three weeks, I was able to interview a large number of importers and Chinese dealers handling citrus fruits as well as other fruits and vegetables. A fairly good general picture of the methods of handling and marketing fruit was obtained and in this regard I was fortunate in having the assistance of the Australian Trade Commissioner (Mr. J. Payne) and Mr. R. Rew, representative of Wespak Ltd. Mr. Rew's Chinese assistant who acted as interpreter during many interviews with Chinese dealers made it possible to obtain information, which could not have been otherwise obtained. I was also able to follow up the discharge of the following cargoes of Valencia oranges: Approximately 3,500 cases from the Eastern States which arrived as ventilated non-refrigerated cargo on the M.V. "Obra" on the 19th November, and approximately 28,000 cases which arrived on the M.V. "Orestes" on the 29th November. The latter shipment was non-refrigerated but not ventilated in the proper sense of the word.

I understand the fruit ex the M.V. "Obra" came mostly from South Australia and the bulk of the cargo ex the M.V. "Orestes" came from South Australia, Victoria and New South Wales; 2,720 cases were loaded at Fremantle together with 75 cases of grapefruit and 58 cases of lemons.

The following remarks are based on the observations made on these two shipments which arrived from Australia during my stay and the information gained from interviews with primary importers and Chinese dealers, many of whom are importing direct.

1. WESTERN AUSTRALIAN ORANGES (VALENCIAS).

Condition.—The general condition of the oranges was very good. Wastage due to mould was light and it did not on the average exceed five per cent. on both vessels. This is mostly due to the fact that the journey from Fremantle is of short duration, normally between seven and 12 days. When the market was down owing to the large quantity of fruit discharged from the M.V. "Orestes," much of which was in a deteriorated condition, it was very noticeable that a lot of West Australian fruit was cool stored.

Fig. 2.

Deck stowage on the M.V. Charon. The fruit is well protected from damage by heavy rain. In the upper left and right hand corners appear portions of the canvas wind chute used to ventilate sheep and fruit in the lower and upper cattle decks.

(Photo. by H. R. Powell.)

Quality.—Quality was variable, some lines being very good and others just passing minimum export standards, blemishes were not an outstanding fault. The outstanding defects are discussed in the following section.

Defects noticed.—Oranges are grown in Western Australia over a very wide range of soil and climatic conditions and it is to be expected that there would be a considerable amount of variation in quality.

(a) *Colour.*—The Chinese prefer bright orange coloured fruits and consider yellow colour as an objectionable feature. In a number of instances, Valencias from Western Australia did not come up to this requirement; the fruit was pale in colour and thus prejudiced the buyer from the outset. It can be pointed out that most of the fruit seen from the other Australian States was of good colour and this was reflected in higher wholesale prices. Although fruit grown in the Chittering-Bindoon districts was on the average better coloured than fruit grown in the other districts, it was not always good.

(b) *Sweetness.*—Some Chinese dealers said all Australian oranges were sour and the comparison is made with the Chinese and Siamese mandarin oranges which are sold in Singapore in large quantities. These fruits are particularly sweet and are very popular. As far as fruit from the other Australian States are concerned, most of those interviewed said that the South Australian were the sweetest. This contention was tested out rather thoroughly and I came to the conclusion that, generally, West Australian fruit was not up to the South Australian standards. This would not be a serious disadvantage however, provided the oranges are brightly coloured.

(c) *Skin Texture.*—Coarseness of the skin was one of the major defects noted. Owing to the relatively light crop and the consequent incidence of large sizes, this defect was perhaps more exaggerated than what could be expected in a normal season. On the whole, oranges from the northern areas were more even textured than those from the other districts. In this regard however, some coarse fruit was seen from the Northern districts.

(d) *Shrinkage.*—During the voyage a considerable amount of shrinkage takes place but it was not so pronounced as with oranges from the Eastern States, due to the shorter voyage. The impression given to the buyer is that the cases are not properly packed.

(e) *Thrips.*—Some lines were marred by dark blemishes around the buttons of the fruit, caused by thrips. It was mostly associated with fruit from the Hills and Coastal districts.

(f) *General.*—Notwithstanding these defects, dealers stated that generally Western Australian fruit possesses excellent flavour and a high juice content. They pointed out, however, that although fruit is sold on appearance, there is a decided preference for well known brands. Unfortunately, owing to the relatively small quantities of fruit exported from this State and the large number of shippers handling consignments it is very difficult for even the better quality fruit to obtain recognition. For example such brands as the South Australian "Southoss," the New South Wales "Cock" or the Victorian "Gloria" are well known on this market.

Suggested Improvements.

(a) *Zonal Brands.*—Owing to the differing climatic and soil factors associated with citrus fruits in Western Australia, there is a great amount of variation in the quality of the fruit submitted for export. Inspection standards have been very considerably tightened and much has been done to reduce blemish tolerances. From the inspection point of view it is very difficult to reject fruit which fulfils the conditions laid down in the regulations but yet is not up to the quality required to build up an export market. It has been suggested that the fruit grown in the northern districts generally possesses more of the characteristics of good export quality. The best lines from these areas compared very well with the best lines from the other Australian States. It is thought that when the world wide financial restrictions are removed, Californian citrus fruits will tend to revert to their pre-war position on the Singapore market. Should this happen, there is a strong possibility that the demand for Australian fruit will decrease and it is likely that Western Australia will be seriously affected. It is felt that something should be done now to place at least a part of the export trade on a permanent basis.

One possible solution to the problem is given as follows:—

As the northern districts grow the fruit which it is thought has the best chance of meeting competition on this market, it is suggested that, provided the desired higher standard is reached, it be forwarded under a common zonal brand, irrespective through which exporter it is shipped. This is not to say that good quality fruit is not packed by growers in other districts but the contention is that average quality is lower in these districts. Fruit from other districts could be included under a similar scheme.

(b) *Packing Sheds.*—Most of the fruit seen was well packed but there was a marked lack of uniformity. This applies to sizing and quality equally to fruit from all districts. The institution of central packing sheds would do much to promote even export lines, and at the same time serve to divert unsuitable fruit to local market or factory use. Under the present system each grower when requested to supply an export order, packs what he considers to be his best line. Under this system it is difficult to achieve uniformity.

(c) *Presentation.*—The presentation of the better lines of Eastern States fruit was striking. The fruit was well packed of high quality, well coloured and properly sized. Attractive labels were used and the fruit was sold in such quantities that any particular brand could become well known.

Suggested improvements are as follows:

Wrapping Paper.—One Eastern States packing house was using orange coloured wrapping paper with very good effect and the dealer concerned expressed a preference for this colour. It is suggested that the adoption of this idea would be worth considering. It also might be mentioned that one particular line of Eastern States fruit was wrapped in green oiled wrapping paper commonly used for granny smiths. The dealer concerned was pleased because he thought the fruit was waxed.

Labels.—It was suggested earlier that zonal brands might assist in preserving an important export outlet for the State. The adoption of labels in conformity with this could have improved results. The Chinese are susceptible to appearances and good presentation is essential on this market. American grape exporters use striking designs on their labels and some of the leading Eastern States brands or labels were also very attractive. The use of colours is important, for instance, black and white are not popular with the Chinese as they are mourning colours, red and yellow are favoured in this order, but as yellow is a royal colour it should not be over-done. Green is the most popular colour.

When labels are used the greatest care should be exercised in ensuring that they are properly attached to the cases. There were instances of lines from the Eastern States which arrived in an unsightly condition owing to the labels becoming loose or badly torn. Labels on the American grape cases were so firmly attached that it was difficult to secure even one or two specimens to bring back.

(d) *Sweating.*—So far as the valencias were concerned, most of the fruit arrived in good condition, free from serious mould break-down. One of the defects, however, noticed was shrinkage which was considerable; this could be offset to some extent by sweating the fruit prior to packing. This would be even more important with navels packed during the wet months of June and July to minimise mould wastage.

(e) *Cases.*—All the Western Australian fruit was packed in Redwood dump cases and were all double wired and arrived in an undamaged condition. The quality of the cases seen was fairly good, but certainly not up to the level of the pre-war case. They are popular in Singapore and are handled very carefully by the Chinese on account of their resale value. When opening the cases they carefully prize off the boards and even keep the nails. There was no suggestion that the standard citrus box should be used.

(f) *Counts.*—I was informed that the counts most in demand range from 112's to 168's.

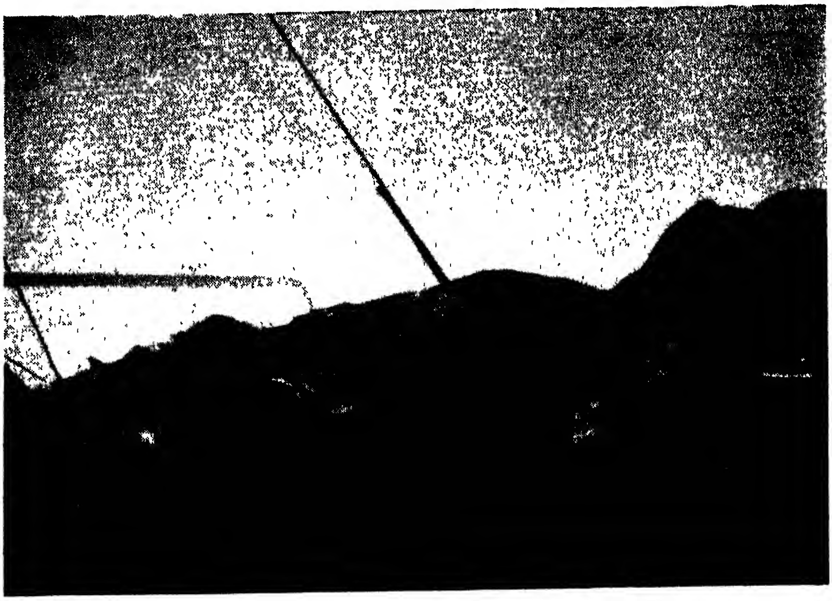


Fig. 3.
Deck stowage on the M.V. Charon. The coverings are tucked up during fine weather to provide ventilation.
(Photo. by H. R. Powell.)

Wholesale Prices.

A number of complaints was received concerning the higher cost of the fruit in Western Australia than in the Eastern States. I was informed that the difference was 6/-, 26/- as against 20/- a case. The c.i.f. cost is similar due to the lower freight rate from Fremantle.

The following figures were given of the cost covering the landing of Western Australian fruit in Singapore:

Cost f.o.b.	26/-		
Freight and Ins.	7/6		
	——	33/6 =	$11.50c.
Commission 5%			60c.
Landing Charges			30c.
Total landed cost			$12.40c.
			(£1 16s. 0d. approx.)

Two shillings and eleven pence is taken as the equivalent of the Malayan dollar, and threepence half-penny the equivalent of ten cents.

It was stated that dealers had to sell at $12.40c. (£1 16s. 0d.) a case to cover costs, and that during the previous two months sales had been below cost, ranging between $11. (£1 12s. 0d.) and $12. (1 15s. 0d.). Western Australian valencias ex the M.V. "Charon" were selling from $9. (£1 6s. 3d.) to $10 (£1 9s. 2d.) a case irrespective from which district they were grown. During the early part of my stay there were relatively small quantities of Australian fruit on the market—Eastern States valencias ex the previous "Burnside" were selling ex cool store at

$9 (£1 6s. 3d.) a case. These oranges were alleged to have arrived in a poor condition and that it was necessary for most of the fruit to be picked over. The cost of repacking was stated to be 30 cents, 10½d. a case.

Western Australian oranges ex the "Orestes" were in competition with large quantities of oranges from the other Australian States. Although the condition of the fruit was in most cases far superior, prices were generally lower than for Eastern Australian fruit, even with wastage as high as 20%. Prices ranged from $6.50c. (19/-) to $8. (£1 3s. 4d.) a case as against $8 (£1 3s. 4d.) to $10 (£1 9s. 2d.) for fair to good quality fruit from the other States. In a number of instances, however, wastey lines from the Eastern States were selling between $2.50c. (7s. 3d.) and $3 (8s. 9d.) a case. In one instance noted, West Australian oranges were sold by auction outside one dealer's premises for $6 (17s. 6d.) a case.

It was obvious that even the best quality oranges from Eastern Australia were not selling at profitable prices. This was due to a lack of confidence in the holding capacity of the fruit owing to its arrival, in a poor condition and the fact that the "Narbada" was expected to arrive in the near future with a large cargo of fruit from the Eastern States. The position was, of course, aggravated by the fact that large supplies of Chinese and Siamese mandarin oranges were on the market.

Fig. 4.
Deck stowage on the M.V. Charon, similar to Fig. 3.
(Photo. by H. R. Powell.)

2. WESTERN AUSTRALIAN LEMONS.

The condition of Western Australian lemons ex the M.V. "Charon" and M.V. "Orestes" was not good. Only small quantities were involved but they arrived in a badly deteriorated condition. Sixteen out of a line of twenty-seven cases which arrived in the M.V. "Charon" were picked over on the wharf and the pile of rotten fruit was left by the importer on the wharf. One case seen contained over 60% decomposed fruit caused by Blue Mould.

Another line seen ex the "Orestes" was in a similar condition. However, fruit seen in the markets and in the retail shop of the Singapore Cool Store Company in Orchard Road over a period of three weeks, appeared to hold their condition very well. Most looked their age but there was not very much evidence of subsequent wastage.

The prospects of selling considerable quantities of lemons on the Singapore market is remote; sales are mostly restricted to the relatively small European population. There is an abundance of various types of limes and they are preferred to lemons by the great majority of the population, including many Europeans.

3. WESTERN AUSTRALIAN GRAPE FRUIT.

Although I did not see the small consignment which arrived on the "Orestes", a quantity displayed for sale was noticed at the Retail Shop of the Singapore Cool Storage Company in Orchard Road, and at the Orchard Road Market. The retail price was 40 cents (1/2) and 30 cents (10½d.) each respectively and it was obvious that sales had been very slow. The fruit was old looking but was still in good condition. I was informed that grape-fruit are only used by the European population and thus have a very limited sale. It can also be mentioned that the older residents have become accustomed to Bali oranges, pomeloes, instead of grape-fruit.

4. WESTERN AUSTRALIAN NAVEL ORANGES.

The general impression obtained was that navel oranges from Western Australia had arrived in a much better condition last season than previously. The chief criticism was that they were not sweet enough. I was informed that the period of lowest orange supplies on this market is May to October, particularly May to early June. It is possible that comparatively small shipments of navel oranges at the end of May would bring profitable returns provided the fruit is well coloured despite any deficiency in sweetness.

5. EASTERN AUSTRALIAN ORANGES.

Whilst in Singapore I had an opportunity of seeing two shipments of Valencias from the Eastern States on the two vessels M.V. "Obra" and M.V. "Orestes", particulars taken at the time are as follows:—

"Obra".—Early in the morning of the 19th November, 1947, in company with the Australian Trade Commissioner, Mr. J. Payne, I saw the discharge of approximately 3,500 cases of Valencias from the M.V. "Obra." This fruit was carried as a ventilated non-refrigerated cargo in No. 5 'tween deck. Forced draught ventilation was used by means of a blower, utilising one of the ventilators, which had been converted for the purpose; it was claimed that the air was continuously forced through the entire hold. No particulars could be obtained as to the capacity of the blower.

The fruit was stowed on pieces of 3 x 3 timber, every third tier, ½in. battens were used every tier and a gully was provided fore and aft to increase the effect of the ventilation. According to the ship's officers the blower was used almost continuously until the vessel arrived in Singapore harbour.

From a superficial inspection of the fruit in the hold the oranges appeared to be in first class order and this was subsequently borne out when the fruit was seen on dealers' premises.

Matters concerning the ventilation of non-refrigerated fruit cargoes were discussed with Mr. Kirkwood Brown and the Calcutta representative, Mr. Easterbrook. I understand that Mr. Easterbrook came down specially to inspect this cargo. In a subsequent discussion with these gentlemen it was stated that the British India Shipping Company were prepared to equip their vessels with blower-type ventilation to meet the requirements of the Australian fruit trade.

One particular line of Valencias consisting of 100 cases was seen being repacked by women coolies at a dealer's premises to fill an army contract. Damage due to mould was slight being in the region of five per cent. Some individual fruits were badly blemished but most were bright and attractive. During the repacking operations no great care was taken and wrapped and unwrapped fruits were packed together, nor were the remnants of breakdown removed from sound fruit. Lines needing reconditioning are not always repacked into the same cases, and this was noticed in several instances.

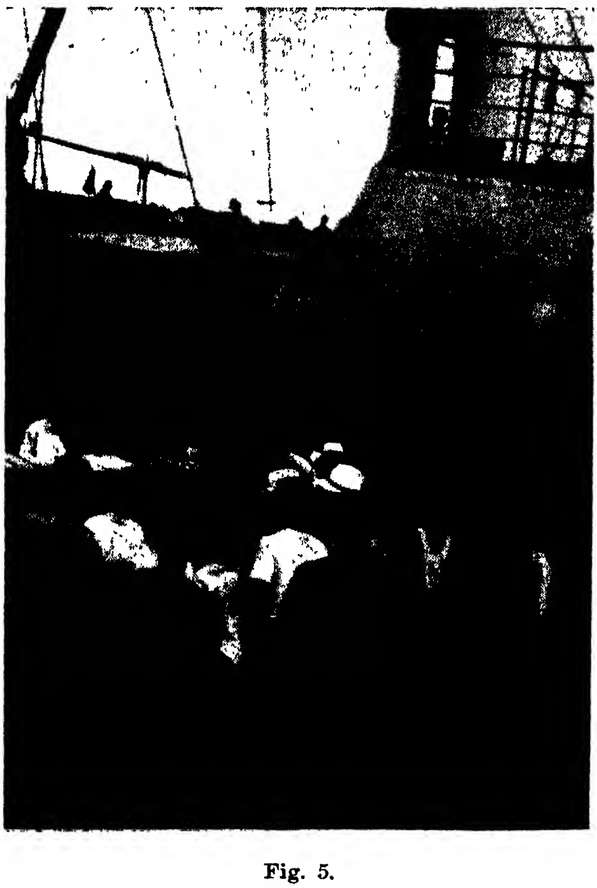


Fig. 5.

Discharge of apples on Singapore wharf ex M.V. Orestes. Buyers were very keen to secure their supplies. It was amazing how lorries which appeared hopelessly traffic-jammed, managed to sort themselves out.

(Photo. by H. R. Powell.)

"Orestes."—This vessel discharged approximately 28,000 cases of oranges, together with 24,000 cases of apples. Discharge was extended to over a week owing to heavy rain and the disinclination of importers to pick up their consignments. Two photographs taken within a short interval show clearly in one the rush to collect the apples as they were discharged and the other, stacks of oranges on the wharf waiting to be claimed.

In the hold the fruit was stacked on end, on boards placed close together on dunnage consisting of 3 x 3 timber. Each case was separated by battens ¼ inch wide, horizontally and vertically. The 'tween deck space was stacked from the roof to the floor and the only ventilation provided was the ship's air vents assisted by the removal of the hatch covers. It was difficult to see what improvement this method of stowage could give. It was stated that the hatch covers were removed during the voyage and that awnings were used when the weather was hot. Pulp temperatures taken in the hold exceeded 80°—the limit of the thermometer carried.

DEFECTS NOTICED.

On the whole the quality of the fruit seen was good despite the fact that much of it arrived in a deteriorated condition due to mould wastage. The following defects were noted:—

(a) *Cases.*—The cases used were white wood dumps and standard apple boxes. These containers did not stand up at all well to the rough handling meted out to them. This applies particularly to the white wood dumps of which large numbers were seen broken owing to the collapse of the jointed endboards. During the discharge the wharf was absolutely littered with orange peel and decayed fruit from the broken cases; photograph illustrates this very well. In addition, fruit was freely ullaged from sound bulged standard apple boxes. A barrel containing water was on the wharf nearby for the convenience of Coolies to cleanse the fruit they were eating.

In some instances the cases were discoloured and dirty and the stenciling was hard to read; in one instance seen the shipping brand was written in and showed up badly.

Many of the dealers interviewed stated that they would like the Eastern Australian exporters to standardise on the Australian apple box. Some complaints were received, however, that when these boxes were packed with a high bulge and through subsequent shrinkage, it appeared that they had been slackly packed. One dealer seriously stated that he was of the opinion that his boxes were one layer short.

(b) *Mould Break-down.*—In the hold it was apparent that many cases were badly affected with mould. In some instances it was almost complete and it was difficult to find a case that was unaffected.

Two photographs taken, one from the deck of the vessel of a loaded truck and the other of a stack of fruit on the wharf illustrate this very well.

On one dealer's premises a considerable number of cases were seen being picked over in an adjoining store-room; the amount of mould ranged from 30 per cent. to 50 per cent. in each case. During re-packing the fruit was cleaned and the cases wiped out; the contents in some cases were all mush. The dealer concerned estimated the cost of picking over at 30 cents (10½d.) a case using his own women coolies. After picking over the fruit was sold at around $8 (£1 3s. 4d.). Most of the fruit was of excellent quality and it certainly seemed a great pity that it could not be carried satisfactorily.

Very little can be done to prevent the incidence of mould wastage until improved methods of carrying non-refrigerated fruit cargoes are obtained. The arrival of the "Obra" was a striking illustration of what can be done. It was amazing how word got around that this cargo was a properly ventilated one; within a few days after discharge very few cases of this shipment were seen on dealers' premises.

(c) Labels.—There were some cases which, in addition to being dirty, were further marred by loose labels. These particular lines gave a very unfavourable impression of Australian fruit. It cannot be emphasised too emphatically that when labels are used the greatest care must be taken to ensure that they are properly stuck on to the cases. The labels used on the American grape cases were particularly good in this regard and considerable difficulty was encountered in removing even one or two to bring back as specimens.

(d) Packing.—In most instances the packing was of a high standard, but some individual lots were marred by the inclusion of badly blemished oranges. Some lines were outstanding and others, fortunately small in number, were poor.

The wrapping paper used included white sulphite, green oiled paper and orange tinted sulphite paper. Most importers seemed to prefer the orange coloured paper.

(e) *Wholesale Price.*—Wholesale prices for valencias ex the "Orestes" ranged from \$7.50c. (£1 1s. 10d.) to \$10. (£1 9s. 2d.) for good quality fruit in fair condition and was down as low as \$2.50c. (7s. 3d.) for badly wasted fruit. Some of the better brands were selling at \$8. (£1 3s. 4d.), even though the contents were damaged by mould to the extent of 20 per cent. It was difficult to get a range of prices for the "Obra" fruit as sales were made very quickly, the only figure obtained was \$11. (£1 12s. 1d.). Most dealers complained that they were selling at a loss and were very apprehensive with regard to the pending arrival of a large cargo of fruit on the "Narbada." During this period, too, the market was very well supplied with Chinese and Siamese mandarin oranges.

(f) General.—The general impression obtained was that the better packs could successfully withstand foreign competition on this market. The difficulty, however, in competing with the fruit from overseas is that the fruit arrives in such a variable condition due to unsuitable sea transport. If shipments similar to that made on the "Obra" could be assured, it appears certain that this difficulty would be overcome.

6. SOUTH AFRICAN ORANGES.

On one dealer's premises I saw several standard citrus cases of South African valencias. The sizes were small, 324's but they were in good condition despite being in cool store in Singapore for approximately two months. There was no mould; only one fruit was seen that had a black dry discolouration around the button. There was a fair amount of superficial blemishes but they were slight and not unsightly.

They resembled very much the markings on some Western Australian fruit referred to by growers as silver russett, wind scurf, etc., but the markings were not so deep nor so well defined as seen in this State.

The fruit was selling around between \$14 and \$15 a case(£2 0s. 10d. to £2 3s. 9d.). The cases were attractive, made of white wood and packed with a

high bulge. Tops and bottoms were of very flimsy construction but the contents were undamaged. The containers were not labelled but were very neatly stencilled as follows:—

324—Valencia Reg. No. 1.
Zebedelia Citrus Estate,
Transvaal,
Empire Produce,
Union of South Africa.

This particular dealer stated that the South African fruit was of a better colour and better flavour than Australian fruit. Although it was of good quality I could not support his contention.

Fig. 6.
Discharge of oranges on Singapore wharf ex M.V. Orestes. Much of the fruit arrived in a bad condition and importers did not appear anxious to pick up their consignments.

(Photo. by H. R. Powell.)

7. CHINESE ORANGES.

(a) *Mandarins.*—During the period I was in Singapore there were large quantities of both Siamese and Chinese mandarin oranges on the market. These mandarins were large, ranging from three to four to the lb., light yellow in colour and with a very thin skin. The fruit itself is very juicy and sweet and is very popular with the Chinese. The season extends from the end of November to March and the periods of heaviest supply are January and February. The fruit is important with the Chinese community in connection with the festivals carried out during the New Year. I was informed that at this time it is customary for every member of a household when visiting another household to carry two oranges; with the exchange of New Year greetings the fruit is handed over and two others are received.

I was informed that bushel size cases with ½in. spacing between the boards are used. The net contents are approximately 40 lbs. and in some instances the fruit is wrapped in ordinary tissue paper. The journey from China takes up to 15 days and the mandarins are normally stowed as deck cargo. The landed cost is approximately $14 (£2 1s. 0d.) a case, and during the time I was in Singapore wholesale prices were in the region of $17.50 (£2 11s. 0d.). The fruit is usually sent on consignment and sold on a commission basis of five per cent.

(b) *Valencias.*—I saw several small lots of Chinese valencias which were very yellow in colour and immature looking. I was informed that the condition and quality improve greatly later on in the season. I understand that the landed cost ranges from $15 to $18 a picul. (£2 3s. 9d. to £2 12s. 6d. for 133 lbs. or approximately 13s. 2d. to 15s. 9d. for 40 lbs).

8. SIAMESE CITRUS FRUITS.

(a) *Mandarins.*—This fruit is also very popular with the Chinese. They are smaller in size than the Chinese mandarins and would go approximately six to the lb. Colour is greenish and the flesh is succulent and sweet and the skins are very thin. The fruit is imported from Bangkok in crates containing approximately 30 kattis of fruit (40 lbs.)

The wood used in making the crates is thick, approximately 1in.; and banana leaves were used as packing material. The crates were tied with rope and the overall dimensions were 24in. x 13 in. x 20in. I was informed that the season of greatest supplies extends from October to December and that the landed cost is $30 a picul (133 lbs.) (approximately £1 6s. 4d. for 40 lbs. of fruit.)

(b) *Pomeloes.*—Known also as the Bali orange, this large fruit arrives in wicker baskets or in bags. Each bag contains approximately 100 fruits, weighing approximately 150 kattis (200 lbs.). They are sent on a consignment basis and the dealer charges 5 per cent. commission. At the time of my visit they were selling at 25c. each (approximately 9d.) wholesale. They are very popular and to a large extent fulfil the uses of grape fruit with the non-European population and many older European residents.

9. MARKET CAPACITY.

Unfortunately my stay was too short to attempt to gauge the extent of the orange market for imported fruit, the only considered estimate obtained was 16,000 bushels a month. Under normal conditions large supplies of Californian and Palestinian oranges come on to the market and South Africa is extending her trade in this direction. Supplies have also been received from Portugese East Africa and it is possible that this trade will grow.

10. RETAIL MARKET PRICE.

The bulk of the retail trade is done in native markets by hawkers, and at roadside stalls. The quantity of fruit of all types displayed for sale is tremendous.

Retail prices were out of all proportion to wholesale prices. Sellers and retailers, of which there are only a few as we know them here, appear very hesitant to increase sales by reducing prices; they evidently prefer a high margin of profit and a smaller volume of sales. It is very obvious in the native markets that much of the fruit seen on display was old. During the time of the discharge of the "Orestes" wholesale prices were in the region of $6 (17s. 6d.) to $10 (£1 9s. 2d.) a case, but this was not reflected in lower retail prices.

The following two sets of figures taken during the first week of my arrival and the last week I was in Singapore—a period just over a fortnight—set out the retail prices at three representative centres, namely: the retail shop of the Singapore Cool Store Company in Orchard Road, the Orchard Road market, mainly patronised by Europeans, and wealthier Chinese, and the Native Market at Beech Road:—

———	Singapore Cool Storage.	Orchard Road.	Beech Road.
Pomeloes	65c. ea. (1s. 11d.)	65c. ea.. (1s. 11d.).	...
Siamese oranges	65c lb. (1s. 11d.)	60c. to 80c. lb. (1s. 9d. to 2s. 4d.)	...
Australian oranges	20c. eac. (7d.)	20c. ea. (7d.)	15c. ea. (5d.)
Australian oranges—140's W.A.	25c. ea. (9d.)	...	...
Limes, Siam (small and green—marble size)	70c. lb. (2s. 0½d.)	50c. lb. (1s. 5½d.)	20c. katti (7d.)
Lemons	15c. ea. (5d.)	...	15c. ea. (5d.)
Grape Fruit	40c. ea. (1s. 2d.)	30c. ea. (10½d.)	... ...

———	Singapore Cold Storage.	Orchard Road	Beech Road.
Pomeloes	65c. ea. (1s. 11d.)	...	...
Siamese oranges	65c. lb. (1s. 11d.)	60c. to 80c. lb. (1s. 9d. to 2s. 4d.)	70c. lb. (2s. 0½d.)
Oranges, Australian	15c. to 20c. ea (5d. to 7d.)	15c. to 20c. ea. (5d. to 7d.)	15c. to 25c. ea. (5d. to 9d.)
Oranges, Chinese	...	$1 20c. lb. (3s. 6d. or 10½d. ea.)	$1 10c. lb. (3s. 2½d.)
Oranges, South African (small)	...	10c. ea. (3½d.) 80c. lb. (2s. 4d.)	...
Limes	...	50c. lb. (1s. 5½d.)	...
Lemons (old)	15c. to 20c. ea. (5d. to 7d.)	20c. ea. (7d.)	15c. ea. (5d.)
Grapefruit (old)	40c. ea. (1s. 2d.)	30c. ea. (10½d.)	50c. lb. (1s. 5½d.)

It will be noticed that these retail prices are high and that there is little if any variation during the period.

The retail price of valencias (140's) was 9d. each at the retail shop of the Singapore Cold Storage Company; this is equivalent to £5 5s. a case. The wholesale price of this fruit ex M.V. "Charon" in all probability did not exceed $10 (£1 9s. 2d.).

Another point of interest is that the retail price of two lemons is equivalent to the cost of a pound of limes, which are more convenient to use in this climate and would go a great deal further. The price of Chinese mandarins reflects the greater demand for this type of orange.

Fig. 7.
A wharf scene during the discharge of oranges ex the M.V. Orestes. Coolies salvaging fruit from cases broken during discharging operations.
(Photo. by H. R. Powell.)

GENERAL.

Speaking generally, the market in Singapore during the time I was there was over supplied with fruit as far as profitable returns were concerned. Wholesale prices were depressed and apparently many dealers had suffered losses; retail prices were in the main unchanged, and were very high when compared to wholesale costs.

The arrival of the "Obra" illustrated how the market could be improved merely by the fact that word got around beforehand that the cargo was fully ventilated and likely to arrive in a sound condition. In the past there had been many out-turns similar to that experienced on the "Orestes."

It was very noticeable during the discharge of the "Orestes" that many different brands were used. Some are very well known, others not so much. Californian exporters use three brands, namely, "Sunkist," "Blue Goose" and "Pure Gold." In my opinion it would be advantageous if the number of brands used by Australian exporters could be reduced. A suggestion made for what it is worth is that an over-all State brand for similar quality fruit be used by all exporters in each State. This may not be possible but if it could be done I feel that present and future marketing difficulties would be improved.

The Singapore market is a very complex one and highly specialised, and perhaps the requirements are not so well known in Australia as they should be. Importers have, pre-war, been able to select their requirements from leading citrus producing countries. Owing to financial and transport difficulties since the liberation of Singapore, much of the fresh fruit previously imported from elsewhere, is being supplied by Australian exporters. Last year this trade was valued at £720,000.

It can be assumed that when present international trade barriers are removed, there will be a strong tendency for the Singapore trade to revert back to pre-war channels of supply. This can have a marked effect on the economy of the Australian Citrus Industry.

It is suggested that the retention of a large share of the present trade is dependent upon certain considerations. It is recognised, however, that neither citrus organisations nor exporters have had, up to the present, little if any control over the chief factors involved—namely sea transport and restrictions of quantities exported.

Some of the considerations concerned are as follows:—

(1) Improved sea transport facilities.
(2) Restriction of excess quantities of fruit being shipped; this is important because cool storage facilities in Singapore are restricted, and in any case excess quantities cause nervousness with buyers and consequent weakening of prices.
(3) Restriction of the number of brands used, in an effort to emulate the example of Californian exporters.
(4) Improved presentation with particular reference to—
  (a) cases and standardisation of the type to be used;
  (b) labels being firmly attached;
  (c) elimination of inferior packs.

In conclusion, it should be made clear that the Chinese dealer is an astute business man who knows what he wants. He has no particular love for any country and his driving force not unnaturally is the desire to make profits.

Fig. 8.

Non-refrigerated stowage unless properly ventilated can cause heavy losses to citrus cargoes owing to the development of blue mould. The contents of the cases depicted here were almost completely broken down.

(Photo. by H. B. Powell.)

TOMATOES.

Approximately 1,036 half bushel cases of tomatoes were loaded as deck cargo on the M.V. "Charon" for Singapore at Geraldton on the 6/11/47. They were stowed in four stacks of approximately 250 cases each, port and starboard, on numbers 2 and 4 decks respectively.

In company with Mr. G. Throssell, the district Agricultural Adviser, I examined a number of cases as they were being loaded from railway trucks and found that the condition of the fruit was good, being mainly green; in only a very few instances were any signs of ripening noticed.

A number of pulp temperatures were taken while the fruit was being loaded and they averaged approximately 72°. During the voyage pulp temperatures showed a steady increase and some recordings were as high as 88°.

At Mr. Crothers' request I took with me aboard ship a number of samples of tomatoes in varying stages of maturity wrapped in cellophane paper. These were placed in the cabin and were examined regularly throughout the voyage. Unfortunately the experiment proved unsuccessful. The moisture given off by the fruit condensed on the cellophane wrappings and within five days mould growths were well developed. At the end of 10 days most of the fruit was decomposed, with the exception of one package only, which for some unaccountable reason remained dry throughout the period; the colour of this lot was pinky-yellow on arrival at Singapore.

The fruit and tomatoes stowed on deck were watched during the voyage and data on temperatures and humidities was collected. Unfortunately, owing to wet weather experienced during the last few days prior to berthing a close inspection could not be made as had been arranged. However, early in the morning prior to berthing an examination was made of a number of boxes in each stack and it was found that the fruit was generally, in good condition although there was some slight shrivelling and a little mould was in evidence where the skins had been broken. Colour was mostly green and yellow and (g.y.).

The vessel arrived on the morning of the 17th November, 1947.

During my stay in Singapore which extended to the 5th December, a large number of Chinese dealers and importers handling tomatoes and other fruits and vegetables were interviewed and I was also able to follow up the discharge of 3,000 half bushel boxes ex the M.V. "Gorgon" which arrived on the 29th November, 1947. These tomatoes were in a sound condition but were more forward than the previous shipment; colour was mostly one third green, yellow and red respectively (g.y.r.).

During the course of my enquiries the following information was obtained.

1. BOXES.

The boxes used were generally satisfactory and I saw few instances of damage even when they were not wired. Most of the people interviewed stated that they did not think wiring was necessary. Some complaints were received that the wired boxes were packed too tightly and that the contents were often bruised. A lighter net weight and no bruises is preferred to a more well filled box containing bruised tomatoes.

2. STENCILLING.

On the whole the stencilling was only fair. in many instances the ink used was indistinct. This matter could be easily improved. Growers should realise the importance of making the package as attractive as possible. The adoption of suitably prepared labels would greatly assist in this direction. If labels are used then the brand and colours used would have to be carefully worked out as the Chinese have a curious preferment for certain colours and regard any pictorial brand as representative of the contents. A defect commonly met with when labels are used, is that they are often insecurely attached. This matter would have to receive close attention.

3. CRINKLE.

The type of fruit preferred are those which are round and smooth. Crinkled fruit is definitely disliked and it would not be wise to include fruit of this type in future shipments.

4. SIZE.

Most of the dealers interviewed required sizes ranging from 2 inch to 2¼ inch and preferred 2⅛ inch to 2¼ inch sizes. "Smalls" were disliked mainly I think on account of the price factor. Chinese dealers said that if "smalls" are forwarded they should be sent at a much lower price.

5. BLACK SPOT.

No complaints were received with regard to the disease "Black Spot." Apparently, owing to the climatic conditions in Singapore the disease does not progress any further during transport. Every care, however, should be taken to ensure that no diseased fruit is packed from the blemish angle.

6. SALES.

I understand that during 1946, F. Sadka handled Geraldton tomatoes on a consignment basis of five per cent. commission. Last year direct sales were made to dealers and importers. I understand that the actual landed costs per box are as follows:—

C.I.F. 20s. 6d.	$7.10c.	
Commission 5 per cent.	.40c.	
Landing charges to dealers stores	.15c.	
Making a total of	$7.65c.	(approximately £1 3s. 0d.)

Wholesale prices for tomatoes ex the M.V. "Charon" ranged from $7.50 (£1 2s. 6d.) to $8. (£1 4s. 0d.) a box. Supplies ex the M.V. "Gorgon" were riper on arrival and prices were as low as $3. (9s.) a box. I understand the average life of tomatoes arriving in good condition is limited to about 10 days. When the market is over supplied or the fruit is in a forward condition dealers have to quit, even at very low prices. Cool storage is not favoured.

I received the impression that the importers and dealers were not particularly pleased with the 1947 season. I was told that the first two shipments were profitable and that sales went up to $16. (£2 8s. 6d. a box but subsequent shipments were not profitable and prices received went down as low as $1. (3s.) to $2. (6s.) a box.

As could be expected complaints were made that f.o.b. prices at Geraldton were too high, it was said that c.i.f. prices should be around \$8 (£1 4s. 0d.) early in the season and then, as the market declined, be reduced to \$5 (15s.).

It was prophesied that future selling prices on this market would be in the vicinity of \$5 (15s.) a box. The price factor is purely a question of supply and demand and can be regulated from this end until regular importations are made from the N.E.I.

It was stated that April, May and June were the worst months for profitable sales in Singapore and that prices improve from the end of June onwards.

7. QUANTITIES.

An endeavour was made to ascertain the market capacity, estimates varied from 500 boxes for each M.V. "Charon" and M.V. "Gorgon" to 3,000 boxes for each vessel. It appears fairly certain that if the market could be regulated present f.o.b. prices could be retained. A reasonable estimate would be 4,000 to 5,000 boxes a month using the two regular vessels. A previous M.V. "Asphalion" discharged approximately 8,000 boxes additional to normal quantities ex the "Charon" and "Gorgon" with serious results to dealers and importers and I was informed that losses aproximated to \$6 (18s.) a box. As tomatoes can only be held for relatively short periods it seems obvious that such large shipments could do nothing else but upset the market.

8. DEFECTS NOTICED.

(a) *Deck Stowage.*—The matter of deck stowage was taken up with the shipping manager of Dalgety & Co. who was on board and the Captain of the M.V. "Charon" and it is confidently expected that much better facilities will be provvided in the near future. On the voyage to Singapore fruit stacked on the rails was subject to damage from both rain and seaspray.

(b) *Rats.*—Some damage was also caused to the fruit in the boxes en route through the activities of rats. Once the skin of the fruit is broken mould very quickly commences and the value of the contents of the boxes is lowered.

(c) *Climbing cut-worm.*—A few climbing cut-worm larvae were noticed during the voyage to Singapore but they were much more numerous on the fruit ex the M.V. "Gorgon." They did a considerable amount of damage by breaking the skins of a large number of fruits which subsequently became affected with mould and decomposed. This matter should be very closely watched at Geraldton, particularly with the shipments made towards the end of October and during November.

(d) *Branding.*—A number of instances were noticed where the boxes were incorrectly marked, that is to say, the 2 inches were marked 2¼ inches and so on. In any case large fruit is not popular on this market and care should be taken always to correctly mark the sizes of the fruit on the boxes.

9. HIGHLANDS TOMATOES.

Considerable quantities of tomatoes are grown in the Cameron Highlands approximately 500 miles by road from Singapore, the quality of the fruit seen was in many cases very good, but in some instances appearance was marred by deposits of what appeared to be Bordeaux mixture. I was informed that this

fruit comes on to the market in quantities during the period early August to the end of November and that the average prices are around $8 (£1 4s. 0d.) a half bushel. The fruit seen in the markets was dark green in colour, round and smooth and mostly around 2½ inches in size; when ripe it is very red.

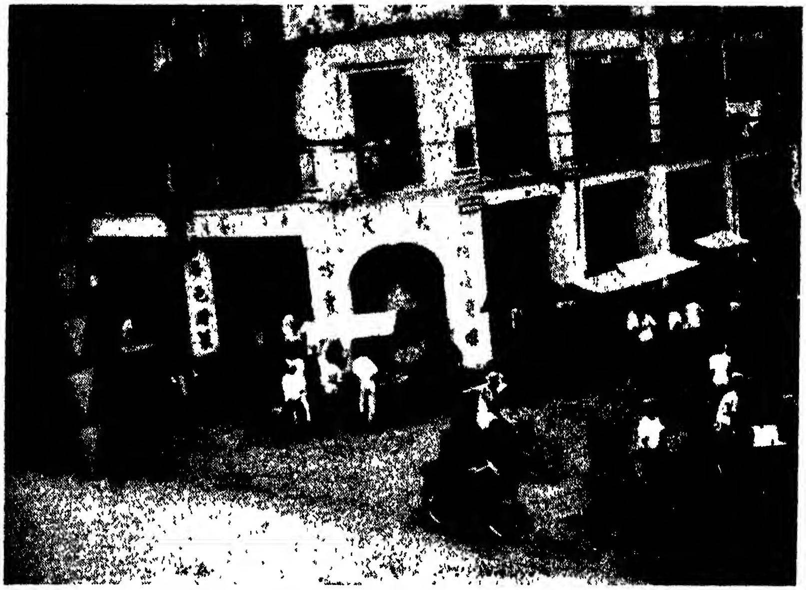


Fig. 9.
A tremendous quantity of fruit is displayed for sale in Singapore. In addition to native markets thousands of hawkers set up business at street corners outside city buildings, etc. The illustration depicts a typical scene.
(Photo. by H. R. Powell.)

10. CHINESE TOMATOES.

In some of the dealers' premises large stocks of Chinese tomatoes were seen. They were packed in baskets containing approximately 150 lbs. net. Sizes ranged from 1½ inches to 2¼ inches. Colour of the fruit was green and yellow in equal proportions and there was a lot of superficial blemish caused by the fruit rubbing against each other due to movement in the containers. Both smooth and crinkle types were included and although they were sound they were inferior to both Geraldton and Highland fruit. I was informed that the wholesale prices ranged from $18 (£2 14s. 0d.) to $20 (£3 0s. 0d.) a picul (133 lbs.).

At the native market in Beech Road tomatoes as small as ½ inch in diameter were seen. I was informed that the supplies from China commence to arrive during November and extended to the middle of June and that the voyage to Singapore is six or seven days.

11. RETAIL MARKET PRICES.

A number of visits were made to a representative retail shop, the Singapore Cool Storage retail shop in Orchard Road; a market mainly patronised by Europeans in Orchard Road and a native market in Beech Road for the purpose of checking up on retail prices. These were as follows:—

———	Singapore Cool Storage.	Orchard Road.	Beech Road.
Tomatoes—Australian ...	60c. lb. (1s. 9½d.)	60c. to 80c. lb. (1s. 9½d. to 2s. 4½d.)	50c. lb. (1s.6d.)
Australian (ripe) ...	...	50c. lb. (1s. 6d.)	...
Highland (large 2¼in. and very ripe)	...	80c. lb. (2s. 4½d.)	80c. lb. (2s. 4½d.)
Chinese	...	...	60c. katti. (1s. 4d.
Chinese, old (2in. to 2¼in. size)	...	...	40c. katti (11d.)

It is obvious from these prices that locally grown fruit from the Highlands are more than holding their own against imported tomatoes and the statement sometimes made that the locally grown tomatoes are inferior, is untrue.

GENERAL.

Geraldton tomatoes are popular in Singapore as far as quality is concerned. Some improvements can be made as indicated earlier and this applies particularly to size, type of fruit and freedom from insect attack etc. The market is restricted, however, as far as present f.o.b. price levels are concerned. If quantities greater than 6,000 boxes are sent each month then it is obvious that the market will be weakened, resulting ultimately in lower prices to growers. If, on the other hand, sales can be regulated, I think present prices can be maintained provided that the size of the fruit offered ranges from 2 inches to 2¼ inches. It appears that some reduction in f.o.b. prices may be necessary as far as "smalls" are concerned.

Close attention should also be paid to the condition of the fruit prior to shipment and no fruit showing signs of ripening or infested with climbing cut-worm should be permitted shipment.

It is interesting to point out that the Chinese do not usually eat tomatoes raw but consume them steamed.

POTATOES.

Although I had no prior intention of making any inquiries regarding potatoes, I had no option; so many complaints were made concerning the size of Australian potatoes in general, and those from Western Australia in particular, that I compiled the following notes in the hope that they could at least be brought under the notice of those interested.

The following information was obtained from a large number of dealers and importers in the course of the inquiries being made on behalf of fruits and vegetables. All those I interviewed were unanimous that the quality of Western Australian potatoes was good and they were far too large for the particular trade requirements of Singapore.

I saw some tubers which weighed as much as 1¼ lbs. each and I was told that there had been instances when they exceeded 2 lbs. These large sizes are disliked for the reason that the main consumers, Chinese and Indians, do not eat mashed or baked potatoes, but like them small for curries and festivals. Large potatoes when cut up for use in curries lose their shape and become mashed during the course of stirring and cooking operations.

I understand that the Indians prefer wherever possible to obtain whole portions of fruits and vegetables and they dislike eating pieces. Another important factor is that when potatoes are retailed, often in small quantities in native markets, both the seller and the buyer dislike receiving and retaining respectively portions of tubers, which after cutting become quickly discoloured.

At the moment there is no general objection to dirt but with competition this matter may easily arise. The Chinese are fastidious and they prefer only brown soil discolouration on the tubers; they do not like black residues, and this applies particularly to importations from Victoria; apparently the black colour is related in their minds to death and decay.

From inquiries made it appears that the wanted weights are those between 2 to 4 ounces, although some dealers preferred 2 ounces. There is a market for the larger tubers with ships' chandlers and the relatively small European population, but it is a limited one.

Another complaint encountered was the extreme range of net weights forwarded from Eastern Australia particularly. It was pointed out that they range up to 135 lbs.; when sales are made by auction it is on the basis of a net weight of 112 lbs. and consequently importers buying supplies at so much per ton tend to lose more on the transaction. It would be wise for net weights of 112 lbs. to be carefully checked when the crates are being filled.

The following interesting information was obtained from a large importer:—

1. He said potatoes from Egypt and Australia are available at the same time and expressed the desire to obtain supplies from Australia as he disliked the methods adopted by some Egyptian traders.

2. He gave the following information as to importation into Singapore for the pre-war year 1939, which totalled 15,000 tons (approximately).

	Tons
Italy	181
South Africa	101
Other African countries	453
Canada	267
India	343
Burma	1,312
Other British Asian countries	1,660
Australia	154
France	132
Holland	2,583
Egypt	1,088
U.S.A.	9
China	1,556
Indo China	5
Japan	3,888
Java	1,515
Sumatra	18
Siam	20
Other Asian countries	10
	15,295

3. He estimated the minimum present day consumption in Singapore was greater than pre-war and was in the region of 20,000 tons a year, due to the shortage of rice and the fact that more money was in circulation.

4. I was told that the Egyptian potatoes arrived in large wicker baskets. The tubers are small and are from brown soil districts.

5. He said that the Australian potatoes were far too large and too dirty. If Australian exporters cannot supply requirements then supplies will be obtained elsewhere.

6. It is the custom of dealers to auction supplies in excess of their requirements and it is important to remember that a 120 lb. crate can be sold at the same price as a 112 lb. crate.

7. The net weights of Dutch crates are always the same, being in the region of 50 kilos or 110 lbs.

8. The Singapore c.i.f. price for Western Australian potatoes is around £32 per ton, that is £24 a ton f.o.b. Fremantle.

At the present time I was told that the cost of importing supplies from Egypt was in the region of £36 per ton c.i.f. The Egyptians met the requirements with regard to size and cleanliness, but consignments are often spoilt by a high per cent. of spoilage, which on occasions reaches 50 per cent.

9. The average voyage from Port Said is 14 days but is longer if the vessels call in at Bombay.

10. The Singapore import quota for Canadian potatoes at the present time is 580 tons. These potatoes are packed in 100 lb sacks, the c.i.f. price being 20s. 6d. a sack, which is around £26 per ton.

11. The freight and insurance on Western Australian potatoes ranges from £6 10s. to £7 a ton—the price f.o.b. Fremantle is in the region of £24 a ton.

12. There is a large demand for small potatoes. He estimated that the supplies needed by ships' chandlers, Europeans, etc., would be only 10 per cent. of the total quantity imported.

13. He said this season the whole South African crop has been bought by the United Kingdom Government. Owing to this fact there will be a greater demand for Australian potatoes. It will only be temporary, however, unless requirements with regard to size and cleanliness are met.

Following the arrival of the "Orestes" and the "Gorgon" almost simultaneously on the 17th November, 1947, visits were made to a number of dealers and to the retail markets for the purpose of checking up on quality, condition and price.

Approximately 9,000 crates of potatoes were unloaded from the two vessels; the Victorian potatoes ex the "Orestes" were only in a fair condition as many of the tubers had shot and were soft. Many of these crates were seen with long shoots trailing out ranging from eight inches to one foot in length.

Inquiries revealed a very poor demand and as far as W.A. was concerned the stated reason was that they were too large and too dirty.

Sales were from $12, (approximately 36s.) to $14, (approximately 42s.) a crate, compared with $16 (approximately 48s.) per crate, the price operating the previous week.

I was told that at the time of the discharge, inferior Dutch seed potatoes were selling at $14 (approximately 42s.) per bag. The price of Victorian potatoes ranged from $10 (approximately 30s.) to $11 (approximately 33s.) a crate.

Visits made to the retail shop of the Singapore Cold Storage in Orchard Road and the markets in Orchard Road and Beech Road revealed the following retail prices:—

——	Singapore Cold Storage.	Orchard Road Market.	Beech Road.
Potatoes—W.A. large ...	25c. lb. (9d.)	30c. lb. (11d.)	15c. lb. (5½d.)
Dutch small	35c. lb. (1s.0½d.)	30c. lb. (11d.)	26c. lb. (9d.)
Cameron Highlands (small, fresh but scabby)	...	60c. lb. (1s. 9½d.)	...

It is interesting to note that scabby but small and fresh potatoes from the Cameron Highlands were retailed at a price round 1s. 9½d. a lb. as against a price ranging from 5½d. to 9d. a lb. for good quality tubers from W.A. The reason of course was that the size of the locally grown potatoes met requirements. These potatoes were more or less the size of marbles, immature, but were suitable for cooking in curries.

During the course of my stay I had the opportunity of seeing potatoes from Holland and from Canada at the Orchard Road Retail market. The following notes were made at the time.

1. *Dutch.*—These potatoes were washed, and adhering to them were particles of a fine light grey soil. I was told that the Dutch authorities ban the export of potatoes from sandy soils. They were all graded and ranged between two and three ounces in size. At that time, the middle of November, the retail price was 40 cents a katti or 11d. per lb. The crates were rectangular in shape and were constructed of white wood. The dimensions were as follows:—23½ inches long, 16½ inches deep, and 14 inches wide. There is a central division and the net contents average 110 lbs.

2. *Canadian.*—These potatoes were approximately twice the size of the Dutch, and they were clean and well graded. The tubers were roundish and somewhat flattened in shape and were very attractive in appearance.

Crates.—Full details of crates from Holland and Belgium is as follows:—

(a) *Dutch.*—White wood rectangular, length 23½ inches, depth 16½ inches, width 14 inches, ¼ inch timber construction. Centre support full width and depth ½ inch timber divides crate in two. ¾ inch timber cleat full depth of crate. Wired both ends. 1 cwt. net.

(b) *Belgium.*—Rectangular white wood, length 23 inches, depth 14½ inches, width 18 inches, and ⅜ inch timber. Centre support skeleton only, does not actually divide the crate. Two different size timbers used. Support measurements 1¾ inches x ⅜ inches and 3¼ inches x ½ inch. Support traverses all four sides; there is also a central upright support, but no supporting cleats. Crate strapped at each end ½ inch steel strapping. 1 cwt net.

GENERAL.

From inquiries made, it appears that a very large market for potatoes exists in Malaya, estimated at approximately 20,000 tons a year. In the pre-war 1939 import statistics given earlier imports from Australia were in the region of 154 tons; I was told that if the size could be reduced to meet requirements, then it was very probable that the large quantities previously obtained from Egypt would be placed in the hands of Australian exporters. During 1939 imports from Egypt were in the region of 1,088 tons.

As far as cleanliness is concerned, that is not so important at the present time, but there is no doubt that it will arise later on. A very great distaste is shown to the black soil residue as mentioned earlier.

As far as the condition on arrival, W.A. potatoes were good but there was some mould in evidence where the tubers had been damaged either by forking or by rough handling during packing and transport operations.

KIKUYU GRASS.

M. CULLITY, Superintendent of Dairying.

KIKUYU GRASS (*Pennisetum clandestinum Pilga*) has been established on farms in Western Australia for approximately 30 years, having originally been an introduction from South Africa.

For a long period no real effort was made by farmers to establish large areas. The grass was considered as a curiosity, although favourable comments on its growth and palatability were frequent. Farmers were loth to expend much labour on the planting of the runners, in view of the many failures which occurred—due principally to a lack of appreciation of the fact that stock, if permitted to graze too soon after planting would pull the young plants out of the ground.

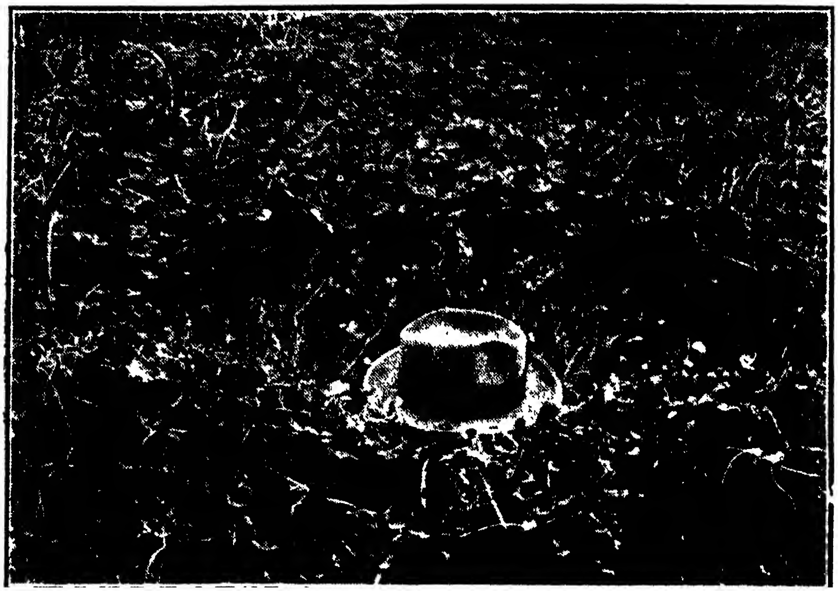
However, with the passage of time, the grass has become very prominent on a number of properties, largely through the persistent efforts of the owners and partly due to the natural spread of the grass by its runners.

Until recently there was no record of the grass seeding under West Australian conditions and therefore all expansion of areas was as described above. In recent years, however, reports have been received, particularly from the more southerly portions of the State, Manjimup, Margaret River, Northcliffe, Denmark and Torbay, that the grass is being spread by seed. A number of seedlings have been found usually associated with cow droppings. It is possible, therefore, that the rate of spread will become much more rapid with the further acclimatisation of the grass.

A small sample of seed was obtained from the Waite Institute in South Australia and this has germinated satisfactorily on two Government-owned properties, the Denmark Research Station, Denmark, and Sabina Vale, Busselton. It is hoped that these will provide nursery plots from which seed will be collected for distribution.

As the grass spreads by extending runners, both above and beneath the surface, its expansion is very rapid under good conditions. It likes friable soils and summer moisture. In these conditions it will give nearly twelve months of good grazing. It gives least growth during the winter months, particularly where frosts are experienced, as these adversely affect growth and give the grass a yellowish colour.

While it will grow vigorously in summer moist conditions, it will survive also in very dry places. In these conditions very little green growth is obtained during the summer. It responds very rapidly to the first rains and gives a reasonable amount of grazing before the annual pasture species have germinated. In this way it is effective in extending the grazing period in the dairying districts, being earlier in the autumn and later at the end of spring.



Subterranean clover and Kikuyu grass growing at Harvey under irrigation.
(Photo by G. N. Lowe.)

Kikuyu frequently is found growing without association with other species, but this should not be taken as proving that it will not grow in association with clovers. Failure to graze fairly closely will allow a dense spongy mass to be produced which has the effect of smothering clover. Where it is prevented from making rank growth it will be found that subterranean clover will grow freely with it. The need for avoiding rank growth is greatest in the autumn.

The grass responds to organic manure, such as cattle droppings and to artificial nitrogenous fertiliser. A basal dressing of one bag of superphosphate per acre each year should also be supplied.

It has been found to be very palatable to all classes of stock. Its feed value is high and therefore it is a very satisfactory species for milking cows. Owing to the density of growth, its carrying capacity is high, not only measured in terms of the number of stock which may be carried at any one time, but also in relation to the length of the period in each year over which it will provide grazing.

Kikuyu grass may become a nuisance if allowed to invade gardens or swamps needed for vegetable cultivation. However, regular attention will prevent its doing damage. A frequently difficulty experienced by the farmer is in handling the spongy mass which results when the grass is allowed to become rank. Before a satisfactory grazing condition can be regained, it is necessary to remove the mass of above-surface runners and dead stalks. This can be done by crowding a large number of stock, preferably dry stock, on to the area so that it is eaten to the ground. Alternatively, the area may be burned before the first rains.

The grass is usually established by planting in furrows three feet to four feet apart and from 1½ feet to four feet apart in the rows. The cuttings should be six inches to nine inches long and be planted about two-thirds beneath the ground. Although many farmers have been successful when the runners have been completely covered, this method is frequently unsatisfactory owing to the likelihood of the cuttings rotting. The furrows may be opened up across the paddock without plowing the whole area, or the grass may be dibbled in a furrow prepared in a crop such as oats, barley or Sudan grass. Many methods are in use, in some of which attempts are made to reduce the labour involved. Some of these will be mentioned in the farmers' notes which follow. Special reference is made to the section describing Mr. J. H. Doley's success.

In many areas, spring planting has proved the most successful, but provided autumn planting is early and the ground is warm, successful establishment can be achieved.

THE GRASS SHOULD NOT BE GRAZED TOO SOON AFTER PLANTING.

If it can be arranged, the paddock, after planting, should be left closed for a full year. For example—if it is dibbled in on a ploughed surface, the paddock should be closed and not opened until the commencement of the following winter. If it is sown under an oat crop, the oats may be grazed lightly and then the area closed for hay and the paddock not grazed during the following summer.

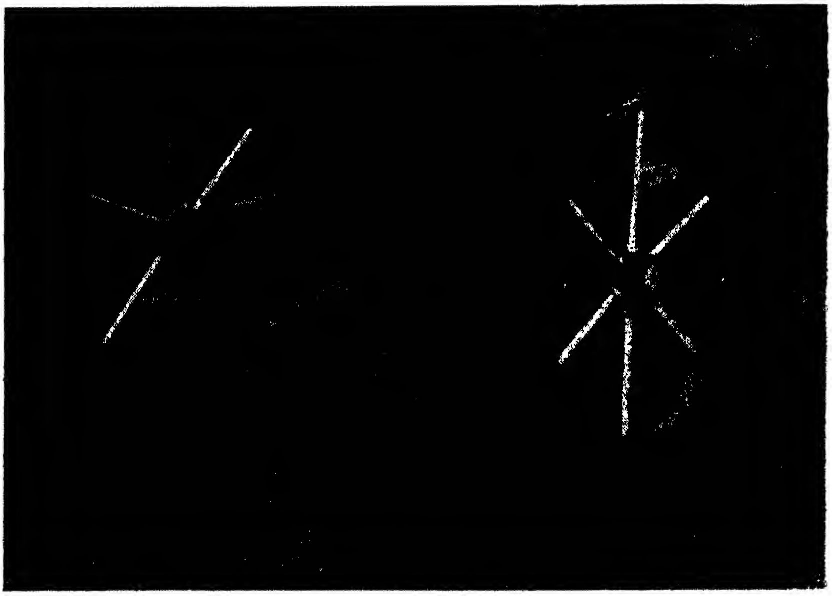
Another successful method has been to dibble in the roots with a crop of maize. No grazing, of course, should occur until the green crop has been removed, by which time the grass has become firmly established. In one such case additional success was achieved by immediately re-ploughing the area, thus cutting up and scattering the plants, and then sowing to oats. In this way the paddock was withheld from grazing for a full twelve months.

Even while the value of kikuyu grass is so great, there is still some reluctance on the part of many farmers to endeavour to expand the areas on their properties, and therefore the opportunity was taken of procuring from a number of successful growers a record of their experience and comments. These are published for the information and encouragement of other farmers.

C. Butler, Walpole.

"The kikuyu was established when I came here, but it has spread considerably since, and the more it spreads, the better I like it. This last season, with rain right through the summer, it has been of immense value for the stock, the cows would come home early before milking time to graze on it. I can safely say that the kikuyu adds considerable value to this property. I have no difficulty in keeping it out of the garden. By having a pad or drain around, all one has to do to see

that it doesn't get across is to pull up the runners crossing it, say, about once a month. The whole mob of cows are on it almost every night and graze on it, we have no other paddocks with kikuyu except patches, but if we shut it off for hay very late, it still gives a very heavy sward of hay, so heavy that it takes two good horses to pull the mower. The hay has a bleak colour, but it is all leaves, no stalk, which is another very valuable thing about it. I want to mention that no matter how tall, the stock will always like it. I have put cows in pig paddocks where besides plenty of white clover, the kikuyu was more than one foot high, yet they took to the kikuyu, if paspalum they wouldn't take it. Every place, in my opinion, should have at least three or four acres around the sheds, specially where the cows camp overnight and the horses can be kept handy whenever wanted. I think this small area would keep a couple of horses and give a green bite right through the year during the night for the cows, no matter how many, besides good grazing for pigs."



Roots being torn up by a rigid tyne cultivator.

W. J. Rooney, Glen Warren, Manjimup.

"We burnt the front paddock just prior to the rain and this paddock, although carrying three sheep to the acre, has beaten the oats in growth.

"We have disked 25 acres of new clearing on the Nornalup Road and are at present sowing kikuyu roots there. We plough a patch and I cut it up with the discs and then fork it on to the truck, and from the truck to the field. We have about 100 acres under kikuyu and I would like to see about 200 acres more. The way it reacts to rain after burning is a revelation.

"We used to lose considerable stock through dry bible or starvation before the kikuyu became established, but we haven't lost any since.

"A neighbour planted 10 acres with roots and he told me that more or as much grass came up from seed as from the roots. In any case, I saw the paddock last week and it was very well established. They cut up a patch of grass with a rotary hoe, sowed it on cultivated ground, cultivated it again, and then rolled the paddock. One thing I have noticed, and that is that you will not find kikuyu growing from seed in any of the bush paddocks or at any distance from where it has been established. So that if it is to grow from seed it would probably be only under real good conditions.

"We usually plant out the roots and when these have established themselves and the paddock has been cultivated a couple of times, the kikuyu takes charge, but not completely, as where it is well grazed the clovers still do well. There is quite a good show of droophead and sub. clover in the front paddock.

"We are all quite enthusiastic about kikuyu until its gets into the garden, and then the more you try to kill it the better it grows. I don't know how it could be renovated except by burning. The tandem discs make very little impression. A fairly heavy caterpillar tractor could not pull a set of tynes through even the small patches."

Clump of roots after treatment by rigid tyne cultivator.

J. A. Nilsson, Margaret River.

"Our first plot (four acres) was established way back in 1926. Method of planting was, land ploughed with a single-furrow disc plough, roots dropped in every third furrow, one foot apart. The method we used now is, go over the land once with a tandem scalloped disc harrow, cut the roots in, say, four or five inch lengths, and broadcast them. The area is disced again and then a stroke of the roller is given.

"You ask for method of control: We don't want to control it—let it go. The sooner it covers the whole farm, the better off we will be. Renovation, yes, that is important. We run the 'Sunprong Renovator' over it, make it go in as far as it will, the deeper the cultivation the better. If the paddock has been neglected, the only way is to put a plough over it. A fire seems to do a lot of good, but I don't believe in fires over the pastures.

"Carrying Capacity.—Our opinion is, we have no grass as yet that can stand up to kikuyu. If any other grass had had the same abuse as kikuyu, why, it would have disappeared never to return.

"Earlier I recommended ploughing an old stand. We do this in autumn and sow Wimmera rye and sub. clover to give us winter and spring feed. After that, the kikuyu comes away better than ever. The other renovating is done in July.

"I like kikuyu for the following reasons:—It gives the stock a green bite almost all the year round. On the hills, it dries off to a certain extent, but should we have summer showers, it responds very quickly. Once the early autumn rains appear, why, man, it simply bolts away, and that's why I consider it so valuable: it beats Perennial Rye hollow. I admit that frost plays havoc with it, but when that occurs, the clover and Wimmera Rye are at their best, and the kikuyu comes again. It is advisable to avoid long, rank growth.

"I honestly believe that kikuyu is the best grass we have in our districts.

"We usually put in 60 or 70 acres of oats for early feed. When we get more areas of kikuyu, I am sure that will not be necessary."

A. Rocchi, Karridale.

"I have 40 acres of kikuyu and have a lot to say in favour of it.

"It covered a very small area when I took over about 12 years ago, and had apparently been recently planted.

"I tried planting an area of new land which had been rung and recleared by myself, but it proved a failure.

"I then planted it in the old clover paddocks on mixed land (some white sheoak sand with coffee rock about three feet below), also in good grey heavy loam with good subsoil, and in fairly heavy clayey soils.

"The method of planting was as follows:—Single furrows about three inches deep and 12 feet apart were ploughed with a mouldboard the full length of the paddocks, the kikuyu runners (about 10 inches long) were placed in the furrows end to end and then the soil was raked back into the furrows and covered the runners completely.

"All of the paddocks were treated with super. and ammonia three to one at a bag per acre for three years. Since then, super., and super. and copper.

"All of the paddocks were good clover paddocks, mostly mid-season sub. with some droophead and a little cluster.

"It took four years for the kikuyu to cover the ground completely, but of course if the original furrows were ploughed about three or four feet apart, it is probable that the kikuyu would have covered the land in the second season.

"I noted that the kikuyu planted in June and July hardly shifted until about mid-September and did no better than kikuyu planted in August and early September.

"Kikuyu on all soils seemed to grow equally well, but stayed greener at the height and end of summer in the heavier soils, but yellowed considerably in the sand.

"In March, 1945, and March, 1946, we burned the kikuyu and followed up with a Massey scalloped disc cultivator, heavy, drawn by a Massey tractor. This did fairly good work, but not good enough.

"My opinion is that it needs an implement like the "Sunprong" to give the roots a proper tearing up at least once in two years.

"Sub. clover seems to grow with it very well, excepting in the fairly wet swampy patches, when the sub. cuts out.

"However, a sowing of burr once in two years seems to keep the sub. there.

"I am all in favour of kikuyu. I dry off all my cows in January and they commence calving about mid-April and are all in within a month. The kikuyu, though only semi-green from mid-January to end of March, enables the cows to maintain their condition easily until calving time, with the result that they are at their top almost immediately, and if we get fairly early rains, late March to mid-April, there is an abundance of young green kikuyu within two or three weeks, whereas everything else—oats and other pastures—are much slower in providing early feed.

"In my opinion, kikuyu's only failing is that it is susceptible to heavy frosts, which yellow it off considerably, but by the time we have heavy frosts, the kikuyu has fulfilled its main purpose, and has provided an abundance of feed when most needed. My figures for average production per cow based on the butterfat delivered to factory, plus whole milk for calves and milk and butter for house, since 1940, are as follows, and I think that kikuyu is one of the main contributors.

Year 1940	235 lbs.
„ 1941	282 „
„ 1942	246 „
„ 1943	300 „
„ 1944	233 „
„ 1945	328 „
„ 1946	272 „

"These figures are absolutely correct, as per my year book."

J. J. Daly, Bornholm.

"The kikuyu grass on my property has been planted some ten years. I have made a practice of planting it on my light land where previously clover pastures deteriorated and went quickly to silvergrass and finally to sand and, naturally, I was very dissatisfied. There was also a crop of bracken on these paddocks. The bracken was difficult to kill owing to the deep nature of the sand. So I decided to have a shot at kikuyu. I ran out furrows with the plough, ploughing to a depth of three inches, every three feet apart, then I grubbed up a large heap of kikuyu roots, chopping up the roots with an axe on the block of wood, chopping the roots up to six inches in length, which I planted along the ploughed furrows one foot apart, then dragging an old tyre of a cart over the furrows to fill in dirt again. The whole of the land was not ploughed, as there was a little clover scattered about which I never interfered with. My cattle could get a bit of grazing while the kikuyu was establishing itself.

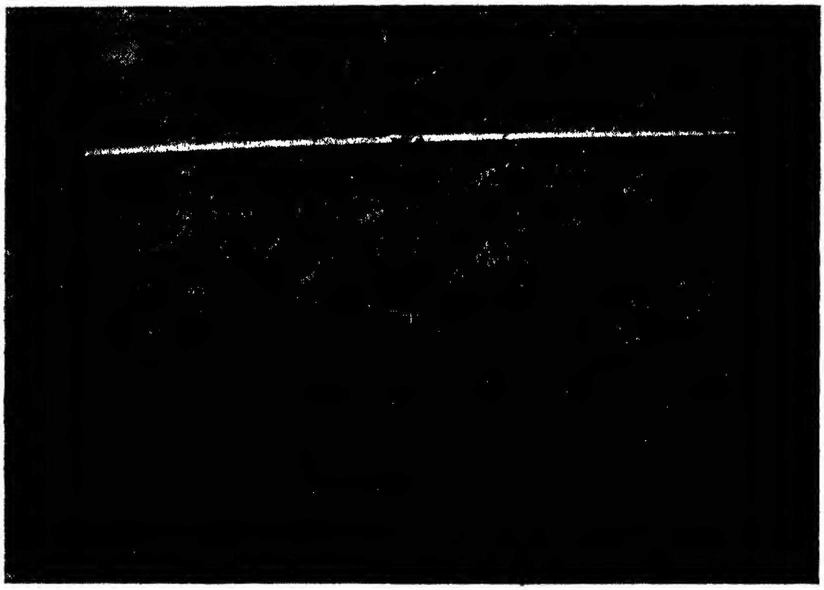
"Kikuyu grass is very easily established on paddocks where clovers have been growing on same. I have also planted it on new land, but found it slow to establish without farm yard manures.

"Anyone trying to establish kikuyu grass should remember it thrives well on farm yard manure. My advice is to make night paddocks for the cattle and harrow the droppings, then the kikuyu will be at its best. Super. also, one bag per acre; but I attribute the greatest success to cow manure.

"Kikuyu grass likes a natural drained soil. It has built my light land to the same carrying capacity as my best soil, it is turning the poor land into a highly profitable venture.

"I have seen around my district rich paddocks of kikuyu growing on land that was one time termed valueless country, only good for bracken. When the kikuyu gets well established, it kills the bracken out.

"Kikuyu is a great boon, as it provides grazing practically for nine months of the year, if summer rains are about. Also it is most useful in the autumn. It comes away well and provides a good bite for stock while the annual pasture is growing.



Roots being freed from soil by pasture harrows.

"I also would like to stress the fact that animal droppings will appear heaviest on kikuyu paddocks and far in excess of other paddocks. This indicates that more grazing has been available. The pasture harrows are needed to spread the manure evenly over the paddocks.

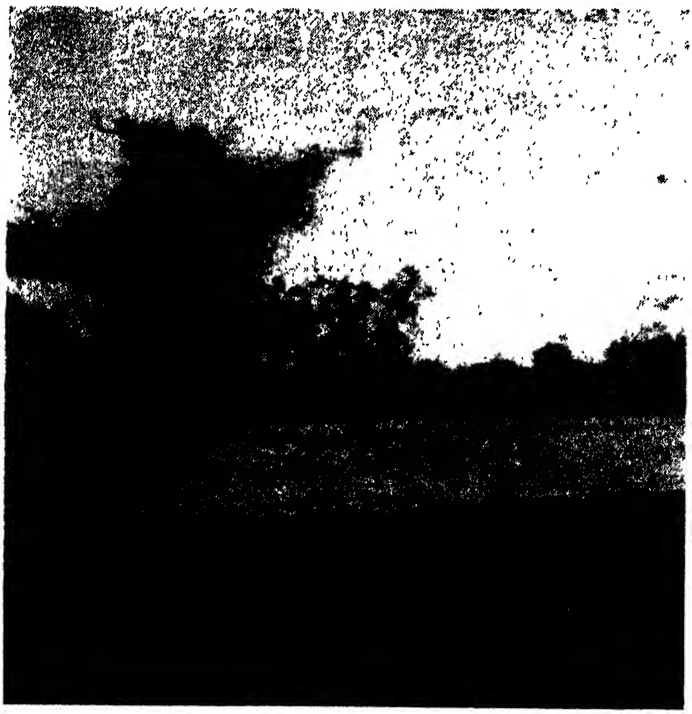
"Some farmers talk of burning kikuyu in late summer, as it shoots up nice and green. I don't favour burning, any rotten dry leaves on the bottom, I contend, should rot back to the soil, not be burnt. Kikuyu is a lover of organic manure.

"My estimation of kikuyu grass, where it can be established, is that it is a highly profitable venture, and I would advocate at least 25 per cent. of each farm area be planted.

"Some farmers, before they plant, talk about putting roots through a chaff-cutter; that is a little miserly. Don't spare the roots—your time will be well repaid."

S. A. Brenton, Parryville, Denmark.

"Kikuyu was put on my peat swamp, which would not stand any man's weight. Therefore it was decided to plant it in kikuyu, water couch, Yorkshire fog, with the idea of forming a solid mat on the surface which would carry stock, and eventually consolidate the swamp. As the peat was so soft we had to turn it over by hand with a goose-necked hoe. Then the job was to dibble in the kikuyu, using pieces nine inches long. These were planted in line three feet apart each way. Then I took a bucket of super. I dropped a handful at each pace, three feet apart, and pushed the root and manure under the surface, making sure it was in the moist soil, well underneath, and tapped it down firmly, as the peat was very light.



Clump of roots after treatment by pasture harrows.

"But let me tell you that I do not advocate kikuyu in a first-class swamp where a farmer can put in potatoes, maize, or any root crops, as kikuyu has been a source of worry to us when we were growing potatoes and maize.

"Having the kikuyu in its young stage, we managed to keep it under control and good crops were taken out. On the head lands, however, it got a very strong hold, and the dustings of the potato manure encouraged it. It formed a solid mat around the head lands and we had an awful job to keep it in check from the time of planting to the next planting of the potatoes, the kikuyu would grow six feet all the way around the paddock, and it got stronger and stronger every year, until it drove us off the potatoes in the end, and so we are faced with a flat of kikuyu, lotus major, with Dutch couch and Yorkshire fog, and so you understand why I do not advocate kikuyu in a first-class swamp.

"Method of Control.—Well, power of course, has come into practice these last few years, and I have been told that a power rotary hoe will rid it with constant tormenting in the heat of summer; but it must be kept on the move, as little pieces soon take root.

"Value as a pasture grass—yes. I maintain it is one of the first grasses to come away. Kikuyu will give the cows a good picking of feed within four to six days after a good shower. Kikuyu grows very quickly, I rank kikuyu as the first feed any farmer should have on his farm, but in the ranking of flush feed for milk, I should be inclined to say sub. clovers, cocksfoot and Rye grasses.

"Weather.—Kikuyu will not stand frost at any time. We have just had an attack of frost a few days ago, and now the flat has gone completely yellow. This will recover again in ten days as soon as the new young shoots come through. That is the only drawback I find with it. Kikuyu will not stand frost on the low flats. On the hills, it is not damaged so much.

"Kikuyu will grow in any sandy ground. We have it all around the hills and only just on coast hills country.

"Carrying Capacity.—Carrying cows on a well established plot of kikuyu is far different from ordinary pasture, as kikuyu always gives a bite. It seems to shoot somewhat more quickly than other pastures. I maintain a cow to 3½ acres is possible all the year around.

"Kikuyu for Hay.—To my fancy, goes very dry very quickly after it is cut. It must be mixed with some other grasses such as sub., lotus major; Yorkshire fog is fruitless to a point, but it helps to bind up kikuyu for cutting of hay."

Sydney Bell, Parryville, Denmark.

"When I first came to this district in 1931 I was very sceptical about kikuyu grass. It was not long, however, before it took complete possession of this beautiful peat swamp, and to-day that land is no longer capable of growing potatoes owing to the density of its growth; but now that this country is a dairy proposition, it has served its purpose very usefully. Clover seed that was sown later, White Dutch, drooping flower, together with lotus major and grasses such as rye and cocksfoot, are thriving and looking well on this country, in spite of the density of the kikuyu grass.

"My one regret to-day is that I did not plant more on my property, because it has excellent feed value. The cows will milk from it, also horses do very well on it; but care should be taken to graze it heavily, and not let it get rank.

"It is susceptible to frosts—the recent frosts we have had in the district has turned it brown, but that does not kill the grass.

"One method of planting is, when ploughing to plant it as you would potatoes, at every third furrow, about three feet apart. By that way you will have an established pasture in a couple of seasons. The other method which is very effective, is to have your land in fallow during the winter months, take a few roots and stamp them in with your foot. This method is suitable if you want to plant large areas and to do it quickly.

"I am planting 10 acres at present by this method—land that I have cleared on paper bark flats. I would strongly recommend it to be planted in small paddocks, where the stock can manure it: like the majority of grasses it thrives on farm yard manure.

"The more you can cultivate this grass the better it grows, but there we have a big problem, especially where it is very thick. The best implement, I think, would be a rotary hoe.

"I feel sure that if more of this grass was planted, especially in the poorer country, it would be a great boon to dairy farmers."

Roots being put into rows by side delivery rake.

T. C. Cooper, Walpole.

"When I took over my holding seven years ago, there was about one-quarter of an acre of kikuyu grass. It was the only decent piece of pasture. This was before I tried copper super.

"I had about two acres of very poor land, the first 18 inches being black sand, and bracken fern about six feet high. Under the black sand there was fourteen feet of white sand overlying clay. I know the depth, because I have put a well down near the spot.

"I cut the bracken, burnt it with a running fire, then planted kikuyu grass every three feet. I fed hay on the pieces, cutting the bracken twice a year. To-day it is as good a pasture as I have got, very little bracken, and a fair sprinking of sub. (Tallarook) clover growing amongst it.

"Since then, I have planted all my poor paddocks the same way.

"Three years ago, I cleared six acres of green stunted jarrah which had been burnt. I used the tractor with the bush and bog at full set. The ti-tree was up to 12 feet high, but having been burnt the year before, it snapped off at ground level. After it had been knocked down, I raked it into rows with the hay rake. After the burn, the bush and bog harrow was used twice. I planted kikuyu grass about four feet apart with a cover crop of Tallarook burr. Now, after three years, it is very good pasture, with very little re-growth.

"I have approximately 30 acres planted with kikuyu. After a while it gets root bound. I have tried burning and find it good. I am sure with suitable subdivision and renovation a man would be able to milk a cow to the acre. I think that kikuyu is very suited for the Walpole and Denmark area.

"I find it does well on sand, stoney and gravel country, but not too good where the clay is very close to the surface.

"I also think that kikuyu grass is as good as two cuts a year of bracken fern, one cut a year with plenty of kikuyu will eradicate the curse."

Bayley Bros., Denmark.

"We have had this grass for about 25 years. It is present in all our paddocks (300 acres). It readily strikes from runners, but we have found the best way is to plant out "turfs" about six inches square placed fairly closely together.

"Winter planting gives good results, the soil being moist and loose, enabling roots to spread quickly.

"Control, so far, has been achieved by heavy stocking, discing with scalloped discs, and infrequently by fires. We do not favour the latter, generally, but we admit that after a fire, a clean, sweet growth is made.

"It grows on a wide variety of types of soil. Even on stony hills, it gives quite a lot of feed.

"Its carrying capacity exceeds anything else we have had since lucerne flea ruined our lucerne.

"The grazing period extends over the whole year, except that on low-lying land, it is often frost-bitten in July-August.

"Its greatest value lies in its ability to 'shoot' after a few points of rain, and it gives the earliest autumn feed. Even during spells of hot, dry weather, kikuyu keeps a cover on the ground, and provides a maintenance ration. Even when well established, kikuyu permits clover, rye-grass to grow freely. For hill country, kikuyu and sub. clover seem to provide an ideal combination. In low-lying land, kikuyu and lotus major thrive together.

"Kikuyu grows in proportion to nitrogen available—superphosphate does not seem to promote growth directly, but by encouraging clovers, nitrogen is introduced. It readily responds to farm yard manure.

"We have carried out limited tests with kikuyu on coast hills with encouraging results, although difficulty in getting clovers to grow there will cause different methods of fertilising. Kikuyu is excellent in preventing erosion on slopes. It definitely checks sweeping fires.

"Against Kikuyu.—When once established, it would appear to be impossible of eradication. It is very hard to mow. It does not make good hay. It spreads steadily, and at no distant future it will be in possession. (If at some time disease of some kind at present unknown should appear, then a 'kikuyu farm' would be in an unenviable position.)

"On the whole, we are decidedly in favour of kikuyu. We carry a beast to less than three acres at all times, and frequently stock more heavily than this. Approximately half our land is partly cleared only, and considerable areas of this land is infested with bracken. We are gradually clearing up logs, etc., and planting more kikuyu which seems to be the only useful growth that offers any opposition to bracken. The carrying capacity will soon be about two acres per head of cattle.

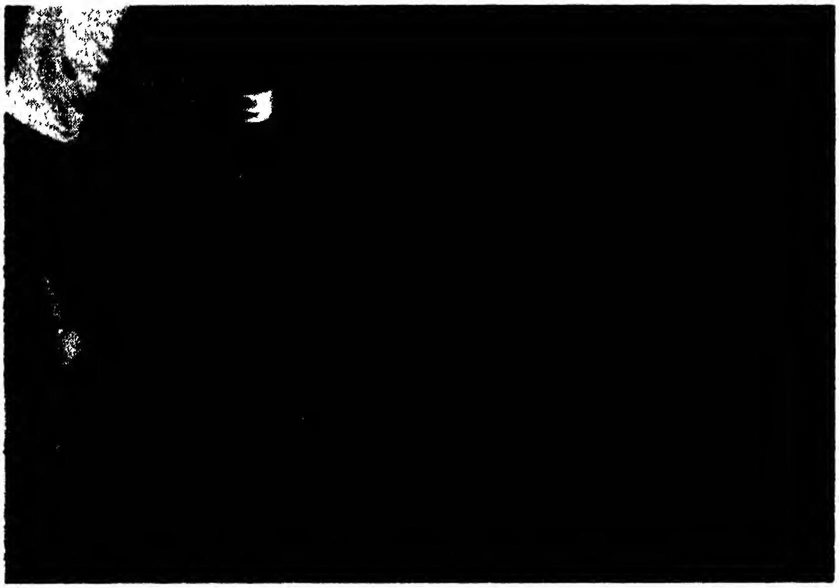
"Kikuyu does not present any difficulty in making silage, at the time when clover is ready for ensiling, the kikuyu is tender and easily cut."

W. Wilde, The Bridge, Hazelvale, via Denmark.

"The grass was first planted about 15 or 16 years ago, that is to say a few pieces of roots were brought on to the farm. The grazable area from those few pieces is about 20 acres today.

"Apart from spreading by runners, stock carry root portions between their hooves. It is also carried further afield when harrowing or logging timber, and there are reports that it is propagated by seed in the droppings.

"On a new piece of land it is very poor, quite unlike other grass or clover which has responded to superphosphate. Kikuyu follows, after you have good pastures which in turn tie down the stock to that spot and so the kikuyu is fed by the droppings which is the start of its ultimate profusion. This time I think would be speeded up by the use of a further manure, say blood and bone.



Roots in a windrow ready for gathering.

"Where it is possible to burn a piece, it makes a wonderful job; within a few days it sprouts again, and from a distance looks like oats. The stock like this new growth very much. It is at its very best in moist ground and it never stays still, but on the higher ground, it looks fairly sick in the height of summer.

"Kikuyu, if well established in any paddock may prevent the cutting of hay. Renovation is best by fire. If possible, a portion should be burnt each year followed by cultivation to spread the droppings.

"With regard to drains, it eventually binds the sides and bottom. The surrounding kikuyu preventing any silt and also stops soil erosion in drains in very wet weather. The difficulty lies in maintaining the proper required depth until the mat of kikuyu in the vicinity of the drain prevents any further silting up.

"I suggest that it is never planted too near the home if at all possible because on good soil your garden is gone for ever.

"The only place where we have planted kikuyu is by the creek and here it is very good indeed, but the total area gets greater each year. My estimation of its value is that it is far superior to Paspalum which in this area has a short season, being dormant in the winter months, growing only in the spring, further it does not establish itself so readily or so well in low lying areas as does kikuyu. Its value in this district is great and certainly well known to most settlers."

J. V. Doley, Byford.

"I have now 150 acres of Kikuyu and expect to plant another 80 acres this year.

"Several methods of collection and planting runners have been tried before the present system has been evolved. We keep one paddock of eight acres for roots because the continual cultivating for roots kills the annuals. A sunpalm cultivator with ¾in. tynes is run through the grass about three inches deep, and six widths, or three rounds across the paddock 10 chains long, will give enough runners to fill a wagon. This will supply enough good runners to plant three feet each way over three acres.

"The cultivator tears the runners and roots about and pulls out a lot of clods. Next a chain and tripod pasture harrow is run over the clods to break them up and shake the dirt out.. Several strokes being needed to make a job of it. A side delivery rake is then used to put it up into windrows after which pitchforks are used to load it into the wagon.

"To plant the cuttings a machine has been made to drop the cuttings into a furrow. Previously a mould board plough was used, but now a machine with a hopper made of two 44 gallon drums, joined end on, to make a trough with an opening at the back end where the operator works, feeding the shaker. A good many clods and cuttings have to be divided by hand. The loosened cuttings are dropped on to a shaker, after the style of a straw walker of a header, which makes the flow of cuttings more even. The cuttings next go down a tin chute which directs them into the furrow made by a 6in. cultivator point. A '\/' shaped scraper is dragged behind the tyne and puts the loose dirt on the cuttings. On the second round the big tractor wheel tyre is run over the last row so that the cuttings and the loose soil are firmed down. Considering the dry summer this year the strike of cuttings has been satisfactory.

"Regarding the value of the grass on my particular property, I cannot speak too highly of its carrying capacity, soil-binding ability against wind and water erosion, resistance to parasites, and ability to withstand endless grazing. I cannot give anything more definite about carrying capacity than to say that on established pastures three breeding ewes with their lambs are run per acre all the year.

"By control I expect you mean the management of the plant and it is on this that the success of establishment and continued usefulness of the plant depends. With the machine now used we put the cuttings into an ordinary pasture paddock and then shut it up. In the spring the crop of pasture hay is cut and the paddock is kept closed during the summer. This first year of nursing is absolutely essential where the soil is inclined to be dry. During the second year judgment must be used in grazing so that the runners are not pulled up or retarded. If this practice is followed the ground should be covered in the third year. I am finding that after the kikuyu is established the clover comes back to its original density.

"The next stage is the control of old and root-bound turf and on this I am still guessing, as I have only just reached this stage of development. From small scale experiments in the garden, I feel sure that if the ground is turned completely over and the top sod severed from its roots, which I know go down at least two feet to the subsoil, a fresh start will have to be made. A good deal of it will die which will give the remaining plants a chance to make a healthy and vigorous growth, which is necessary for it to produce a nutritious and palatable fodder for the animals. If after ploughing, a crop of say, oats, barley or peas were sown on the land a return could be obtained while the grass was becoming established again."

POULTRY FEEDING EXPERIMENTS—No. 4.

By R. H. MORRIS, Agricultural Adviser.

TWELVE months have elapsed since the poultry feeding experiments discussed in recent issues of this Journal were commenced at Muresk Agricultural College on April 1st, 1947.

Readers are reminded that the tests will continue for a further twelve months. In the meantime, a summary of the first year's findings is presented.

The greater part of the data is in tabular form (see Table), but in order that readers may become more intimate with events relating specifically to individual pens, notes on each pen are included.

Ration I.—Control.

Pen I (Australorps)—The birds in this pen averaged 170 eggs per bird for the year and showed the greatest profit of the 12 pens (Table).

Pen 2 (White Leghorns)—The most profitable of the white leghorn pens. The mortality was low for both pens on Ration I.

Ration II.

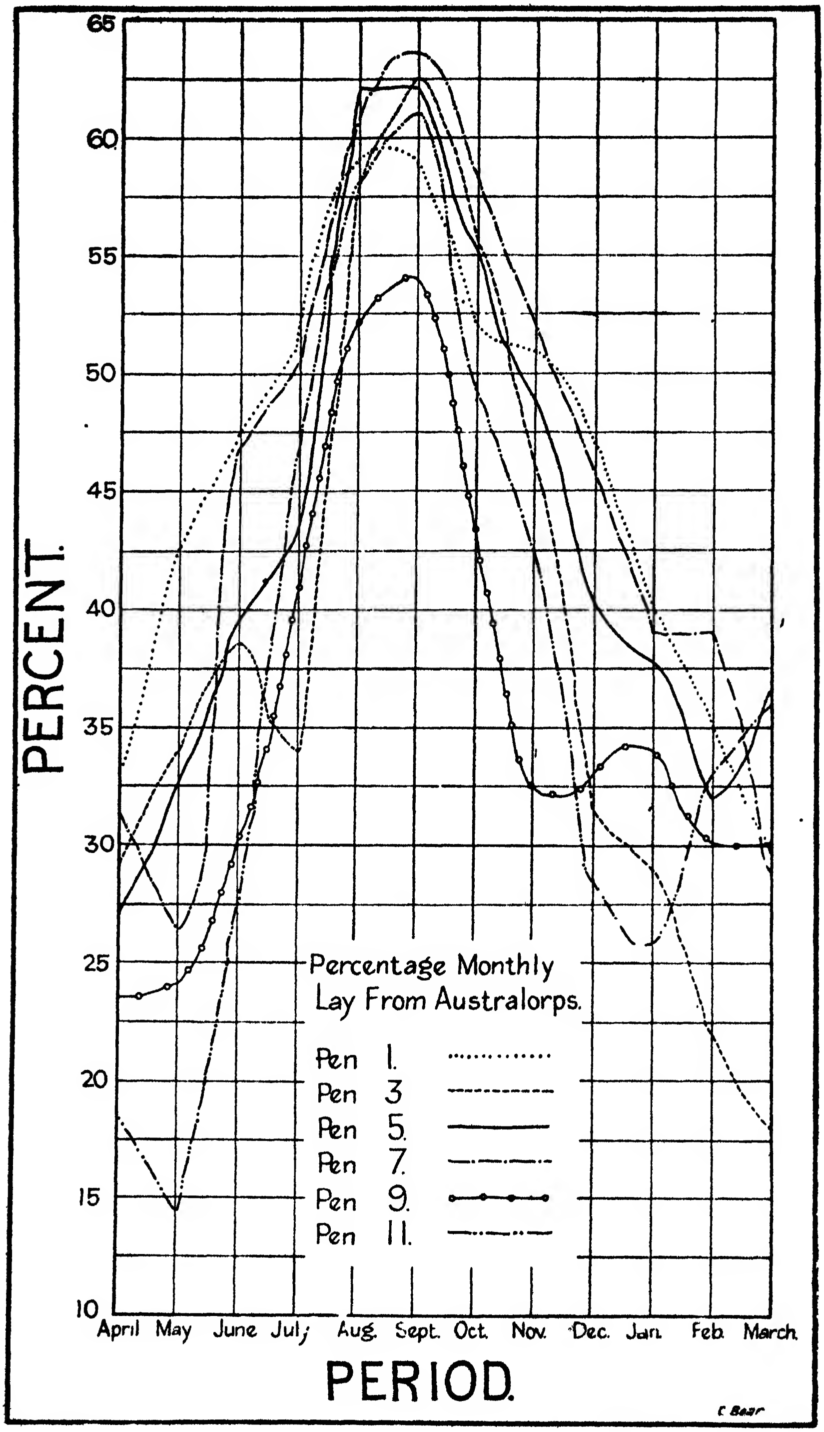
Pen 3.—At first glance the return from this pen does not look encouraging. It is pointed out, however, that the production from this pen dropped rapidly over the last four months of the test, and it is suggested that the high incidence of pullorum in this pen was responsible for this decreased production (see graph I).

At the end of twelve months two pullorum tests at an interval of six weeks indicated that 30 birds throughout the experiment had pullorum. Of these birds, 25 were from Pen 3. The reactors have been removed from the experimental flock. Ninety per cent of the discarded birds from Pen 3 were non-productive at the time of their exclusion from the test and the percentage lay from the remaining birds in this pen improved by 12 per cent. (from 21 per cent. to 33 per cent.) for the week immediately following the exclusion of the reactors. This would seem quite significant when it is realised that the birds were then going into a heavy moult and that the average production from the remaining 11 pens dropped by 4.3 per cent., and by 1.3 per cent. from the other five pens of Australorps for the week concerned. Pen 7 was the only other pen to maintain its production for the week. The production from this pen improved by 0.7 per cent. The profit (value of eggs laid, minus total cost of feed consumed) from pen 3 during the first six months amounted to £17 2s. 9¾d. and for the second six months only £9 14s. 6¼d. The high pullorum incidence was possibly the principal cause of this result.

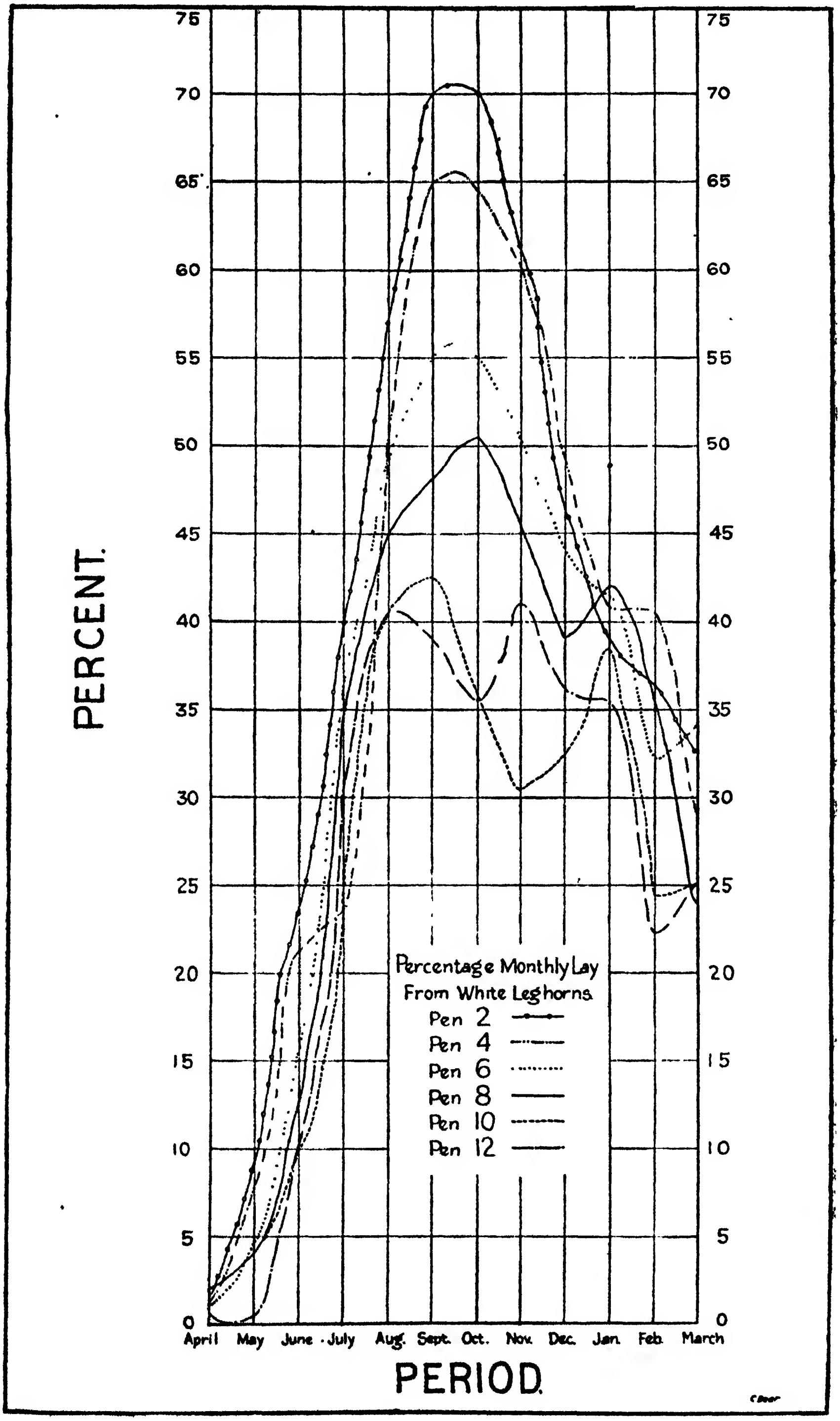
Pen 4.—This pen showed a profit only slightly below that of the control pen of white leghorns. (Pen 2.)

Ration III.

Pen 5.—In Table it will be seen that the cost of food required to produce one dozen eggs amounted to 9¾d. for Pen 5. This was the cheapest of all the pens. However, Pen 5 did not show the highest profit (Table) as many of the eggs laid by these birds were laid during times of cheaper prices. The results obtained from this pen were particularly pleasing and, should they be repeated in


PERCENT.
65
60
55
50
45
40
35
30
25
20
15
10
April May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. March
PERIOD.
Percentage Monthly Lay From Australorps.
Pen 1.
Pen 3
Pen 5.
Pen 7.
Pen 9.
Pen 11.

Graph 1.


PERCENT.
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
April May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. March
PERIOD.
Percentage Monthly Lay
From White Leghorns
Pen 2
Pen 4
Pen 6
Pen 8
Pen 10
Pen 12

Graph 2.

subsequent trials, the practicability of including oats at least at a 20 per cent. level and possibly up to a 40 per cent. level of the total food intake in a laying hen's diet, should be proved. The importance of feeding a suitable type of oat cannot be overstressed. In the current test all the "oat" pens were fed an inferior oat in the first four months of the test during which time the long thin, fibrous, Algerian oat was shown to be unsuitable for feeding to laying hens. For the purpose of feeding to poultry an "inferior" oat is one which contains a low percentage of protein and a relatively high fibre content. Apart from having a low feed value, such an oat is likely to be unpalatable. A variety, such as Guyra, because of its plump grain is most desirable. Crushed Guyra oats are now being fed in these experiments.

The importance of feeding to laying pullets a ration similar to the one on which they were reared is well known by the practical man. In the current tests, birds in groups 2—6 inclusive received a setback in this regard, when they were placed on the experimental ration with consequent retardation of body development and egg production. The birds are now well accustomed to their experimental rations and the second year's returns should give a more reliable guide as to the value of oats as an ingredient in a laying hen's ration.

At this point, it might be opportune to mention that in another experiment, a mash containing 30 per cent. finely gristed Guyra oats has been successfully fed to white leghorn pullets at Muresk since they were hatched last August. They are now nine months old and in addition to the mash referred to above they have received since the eighth week, evening grain, oats and wheat 50-50 by bulk. These pullets are producing as well, and have developed better than the control birds that receive a higher protein ration, composed principally of mill offal and wheat grain. Results from this experiment will be published at a later date.

Pen 6.—Considering the heavy mortality from this pen early in the year, when many of the best birds were lost through cannibalism, the profit shown by the birds from this pen was quite reasonable. Had this vice not been present, the food cost of 10½d. to produce a dozen eggs would probably have been lower.

Ration IV.

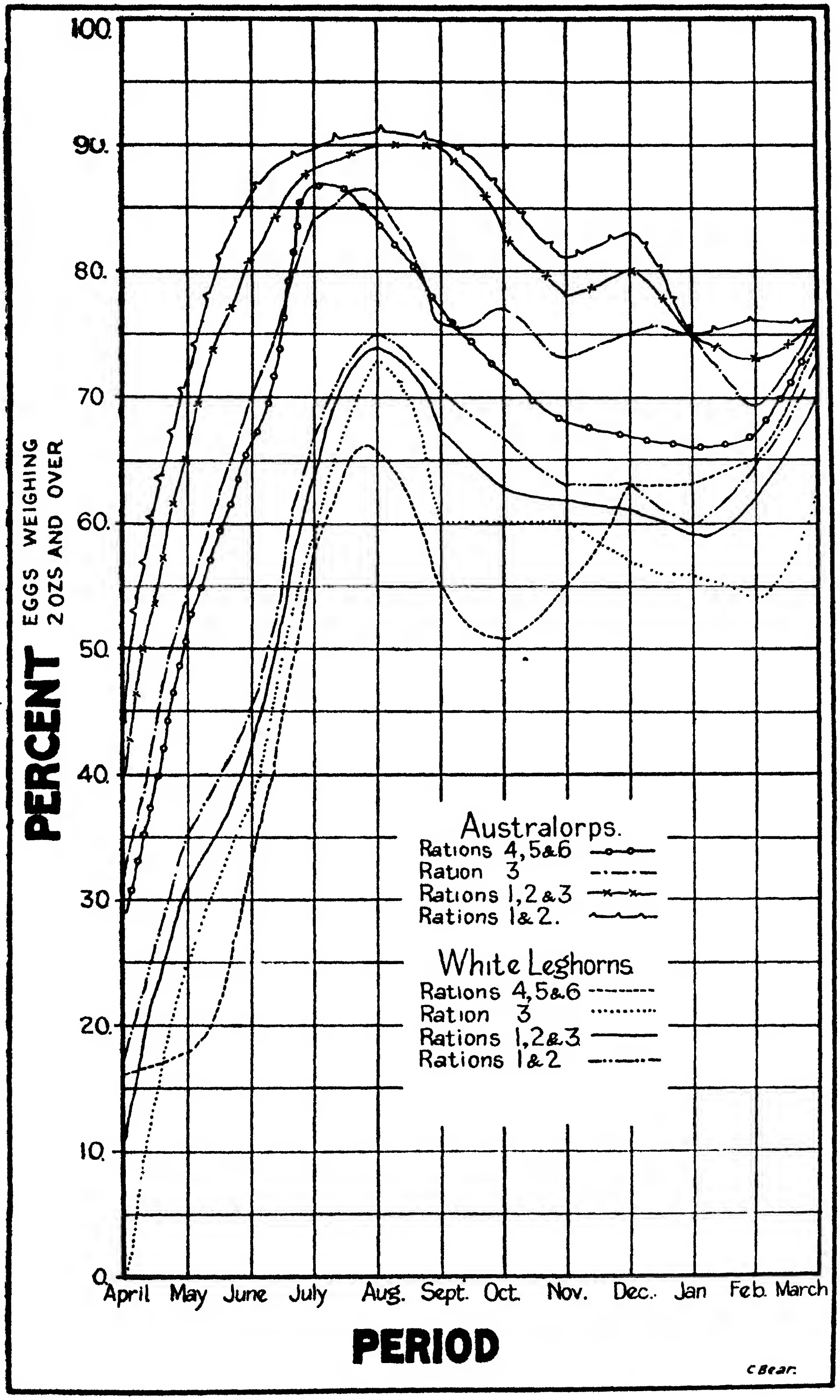
Pen 7.—As the year progressed, it was interesting to follow the increase in egg size of those fowls on Ration IV. For the months of December to March inclusive, the egg size from Pens 7 and 8 compared more than favourably with that obtained from Pens 1-4 inclusive, and was much better than that from Pens 9 and 10.

Although the crushed peas consumed in these experiments cost 16/11d. per bushel, Pen 7 showed a very pleasing financial return at the end of the year. This suggests the importance of carrying out further investigations as to the economics of feeding poultry, not only peas, but other protein-rich leguminous seeds such as the vetch, which could possibly be produced much cheaper than peas, these to be fed in small amounts in conjunction with the now recognised poultry foodstuffs.

Pen 8.—The mortality from this pen was high and the results disappointing.

Ration V.

Pens 9 and 10.—Both pens gave a poor financial return


PERCENT EGGS WEIGHING 2 OZS AND OVER
100
90
80
70
60
50
40
30
20
10
0
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan
Feb.
March
PERIOD
Australorps.
Rations 4,5&6
Ration 3
Rations 1,2&3
Rations 1&2.
White Leghorns
Rations 4,5&6
Ration 3
Rations 1,2&3
Rations 1&2
C Bear.

Graph 3.

Ration VI.

Pens 11 and 12.—The nonpalatability of the algerian oat referred to previously affected these two pens in particular and the results obtained from the birds on this ration were not good.

GENERAL.

Egg Weight.

An article covering the first six monhts of the experiment showed how the relatively high protein rations containing mill offal, favoured the laying of heavier eggs by the young fowls on these rations, when compared with the egg weight of fowls on principally grain diets. It showed, also, that when bran was reduced 20 per cent. by weight as in Ration III there occurred a reduction in egg weight. This tendency continued during the second six months with one exception. From graph 3, it will be seen that:—

1. Rations I. and II. were superior to ration III. for producing heavier eggs with both Australorps and White Leghorns.

2. Rations I., II. and III. were superior to IV., V. and VI. for this purpose with the Australorps and also with the White Leghorns during the first eight months of the test. During the latter four months, however, the White Leghorns on rations IV., V. and VI. produced eggs with a heavier average weight than those produced by the White Leghorns on rations I., II. and III. (See graph 3.)

It will be noticed (refer Table) that the average body weight of the White Leghorns on rations IV., V. and VI. at the end of the 12 months was greater than the average body weight of the White Leghorns on rations I., II. and III. From a comparison of average body weight with egg weight (compare Table and Graph 3) for all pens, a distinct tendency is shown by the heavier birds (pen average) of both breeds to produce heavier eggs. Since the majority of the experimental birds were not reared on the experimental rations, it is difficult to determine the exact influence that the various ingredients of the rations, and more particularly the varying protein content of the rations, have had on body development and egg weight. In view of the inconsistent results during the latter part of the year with the various rations and egg weight, it would appear that the change of rations referred to above influenced egg weight for at least eight months after the change was made. In this regard, and in others, the second year's findings should be of more significance.

Average Weight of the Birds.

From the Table it will be seen that the average weight of the birds in the majority of the pens was lower at the beginning of April, 1948 than it was in September, 1947. In September, 1947, the birds were 12 months old and could therefore be regarded as mature. They were laying heavily and were eating large quantities of food. In April, however, the birds were moulting, less food was being consumed and each pen contained a number of birds that would, on a commercial farm, be culled.

Mortality.

It will be seen from Table that the percentage of deaths was high from those pens on predominantly grain rations and that the percentage from the first five pens (7 per cent.) was reasonable for laying hens under flock conditions.

Prolapse of the oviduct followed by vent picking and cannibalism accounted for five of the deaths from Pen 6. It occurred throughout the year in each of the six pens of White Leghorns accounting in all for 16 birds. Only one Australorp died from this cause.

During the summer, 19 days of over 100°F. were recorded. Fourteen fowls died from heat apoplexy. Ruptured oviducts was another principal cause of death. Thirteen birds died from this complaint.

The three maladies mentioned accounted for half of the total deaths. Chickenpox was evident throughout the flock during the year, and although it accounted for very few deaths, it is reasonable to assume that the depressing effect on egg production was considerable.

A typical case of a White Leghorn hen suffering from feather picking. The rear portion of the bird only is affected. The condition started at the base of the tail and spread over the back and under the body of the fowl. At the time the photograph was taken the bird had been on a wheat grain-meatmeal diet for eight months.

Feather picking was prevalent in Pens 8 and 10 and to a lesser degree in Pen 12, during November and lasted until the birds moulted in March. At the present time, the birds are refurnishing themselves after the moult and the new feathers are not being eaten. It is interesting to note that Australorps on identical rations to the feather-picking White Leghorns were not affected by this complaint and that feather picking has been previously reported as affecting poultry fed principally wheat diets. In the current trial, several of the affected birds became emaciated and showed leg paralysis with no obvious abnormality of the internal organisms on post mortem examination.

	RATION I—control		RATION II		RATION III.		RATION IV		RATION V		RATION VI		AVERAGE.	
	lbs Bran 30 Pollard 10 Wheatmeal 50 Meatmeal 10 Ground Limestone 3 Bonemeal 2		lbs Bran 30 Pollard 10 Wheat 30 Crushed Oats 20 Meatmeal 10 Ground Limestone 3 Bonemeal 2		lbs Bran 10 Pollard 10 Wheat 50 Crushed Oats 20 Meatmeal 10 Ground Limestone 3 Bonemeal 2		lbs Wheat 80 Crushed Peas 10 Meatmeal 10 Ground Limestone 3 Bonemeal 3		lbs Wheat 90 Meatmeal 10 Ground Limestone 3 Bonemeal 3		lbs. Wheat 60 Crushed Oats 30 Meatmeal 10 Ground Limestone 3 Bonemeal 3		Australorps	White Leghorns
Average cost per 100 lb—1947-1948—(shillings and pence)	11 9¼		11 7		12 5		13 4½		13 1		13 2			
Estimated Average crude protein per cent of ration	15 2		15 0		14 3		15 0		13 8		13 5			
	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6	Pen 7	Pen 8	Pen 9	Pen 10	Pen 11	Pen 12		
Mash and/or grain consumed per bird per day—(ozs.)	5 1	4 4	4 3	3 9	3 4	3 6	4 1	3 4	3 5	3 1	3 9	3 6	4 1	3 7
Mash and/or grain consumed per bird per week—(lbs.)	2 2	1 9	1 9	1 7	1 5	1 6	1 8	1 5	1 6	1 4	1 7	1 6	1 8	1 6
Mash and/or grain consumed per egg laid—(ozs.)	10 9	10 6	12 6	10 5	9 9	10 6	8 9	10 6	10 1	12 0	10 8	13 7	10 5	11 3
Average weight of birds—(lbs.) (a) October, 1947 (b) April, 1948	6 5 6 1	4 5 3 9	6 3 5 5	4 0 4 0	6 0 5 8	3 9 4 0	5 8 5 8	3 9 4 3	5 6 5 3	3 6 4 1	5 6 5 3	4 0 4 0	6 0 5 6	4 0 4 1
Average egg production	170	152	141	138	163	123	166	118	128	92	133	96		
Cost of mash and/or grain required to produce 1 doz. eggs—(pence)	10½	9¾	11¼	10	9¾	10¼	10¼	1 0½	10½	1 0½	11¼	1 2¼		
Value of greenfeed consumed at 3d. (per Kerosene tinful of 8 lbs.)	£2 5 9	£2 5 9	£2 5 9	£2 5 9	£2 5 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9	£2 1 9		
Cost to feed each bird for 12 months, greenfeed excluded (shillings and pence)	12 0¾	10 0	11 2¾	9 4¾	10 8	8 10	12 2	10 1¾	9 3½	8 3	10 6	9 6¾	10 11¾	9 4½
Approximate total food cost per bird per week (pence)	3	2½	2¾	2½	2¾	2	3	2½	2½	2	2¾	2½	2¾	2½

Cost of marketing the eggs laid at 3½d. per doz.	£10 1 9	8 17 7½	8 8 1	8 1 0	9 9 8	6 9 4½	9 13 4	6 6 7	7 9 11	5 10 4	7 12 7	5 10 3	...	....
Value of eggs laid (wholesale price)	70 10 6¾	59 4 7½	57 1 2¼	54 6 7¼	65 0 8¾	43 3 1¾	65 19 3½	42 5 5¼	51 4 5½	37 6 8	51 6 7¾	35 15 1½	....	..
Profit per bird per year over food cost greenfeed included (shillings and pence) .	15 9½	13 5½	10 11¾	12 2½	15 2	10 1¾	14 5½	7 11	11 2¼	6 4½	10 4¾	4 7½	13 0	9 1½
Profit per bird per year over total food and marketing costs (shillings and pence) . .	11 8	9 9	7 6½	8 10½	11 2½	7 1½	10 5	5 1¾	8 1	4 3¾	7 1½	2 3¼	9 4	6 3
Number of birds in each pen, April, 1947 . . .	50	50	50	50	50	50	50	50	50	50	50	50	. .	...
Number of birds in each pen, April, 1948 . . .	48	46	46	45	45	36	44	34	43	41	39	42	...	....

SUMMARY OF INFORMATION THAT THE EXPERIMENTS HAVE YIELDED TO DATE.

1. It is impossible to draw definite conclusions from the results obtained to date, but the desirability of feeding laying hens on rations closely approaching the rations they were reared on, in regard to quality, quantity and variety of the ingredients, has been demonstrated. Should the farmer be forced to change his feeding, such changes should be made gradually.

2. The feeding of oat grain as a part of the grain ration also as an ingredient of the mash (preferably in the finely gristed form) would seem economically sound especially today when supplies of other recognised poultry foodstuffs are so short. In view of the results obtained during the early stages of these experiments only a plump, relatively non-fibrous oat can be recommended.

3. On the results obtained from Pen 7, further investigations as to the economics of feeding protein-rich leguminous seeds to poultry in this State would seem warranted.

ACKNOWLEDGMENTS.

Grateful acknowledgment is made to Messrs. K. Cowin and M. Johnson for their ready co-operation in this work.

ANALYSES OF FEEDING STUFFS.

RESULTS of analyses of samples of feeding stuffs taken under the Feeding Stuffs Act, 1928-1946.

(Published under Section 9 of the Act.)

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others
		%	%	%	%	%	%	%
	Anchorage Butchers. Ltd.							
	"Ancho" Meatmeal—						CaO.	
.	Reg. Analysis	†50 56	*15.80	*1 48	0 56	9 30	11.24	
11-3-48	Sample Analysis	38.75	16 2	1.6	0 61	13 57	17 8	..
13-4-48	Sample Analysis	36 9	18.6	1 3	0.76	12.73	16 02	
	Angliss, W. & Co. (Aust.), Pty., Ltd.							
....	"Imperial" Fortified Protein Meal—							
...	Reg. Analysis .	†50.00	*12.00	*2.00	.	.		.
22-10-47	Sample Analysis	53.9	12.2	1.2	. .			
16-3-48	Sample Analysis ..	53.6	12.8	1.5		.		...
	Barrow Linton & Co.						*Limestone*	
	"Dukko" Fattening Mash—							
....	Reg. Analysis	†10.0	†4.0	*4.0	1.0	..	3.0	...
24-10-47	Sample Analysis	11.2	6.6	4.1	0 29	...	1.99	.
14-4-48	Sample Analysis	14.0	4.3	3.8	0.28	..	2.18	....
	"Egglayer" Laying Mash No. 2—							
....	Reg. Analysis .	†10.00	†3.50	*4.50	1.00	...	....	....
18-9-47	Sample Analysis	13.8	3.3	5.5	0.76	..	....	....
	"Eggoleen"—							
....	Reg. Analysis	†40.0	*12.0	*1.5	..	....	....	....

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
8-4-48	Sample Analysis .	37.0	8.7	2.7	..	.		....
	"Excelsior" Meatmeal—							
	Reg. Analysis . .	†40.00	*15.00	*1.50	.	.	.	...
3-9-47	Sample Analysis	39.08	11.48	1.13	. .	.	.	....
	"Growell" growing Mash—							
..	Reg. Analysis . .	†14.0	†4.5	*4.5	1.0	.	3.0	....
14-4-48	Sample Analysis .	15.4	4.2	4.2	0.44	..	2.39	....
.	"Vitalizer" Chick Starter—							
.	Reg. Analysis	†15.00	†4.00	*4.50	1.00	. ..	3.00	...
18-9-47	Sample Analysis	14.4	3.2	2.5	0.8		4 7	.
	David Gray & Co., Ltd.							
	"Western" Chickbuilder—						$CaCO_3$.	
.	Reg. Analysis	†14.50	†2.50	*4.50	. ..	.	1 50	...
22-10-47	Sample Analysis	15 6	2.8	4.3	..		0 2	. .
....	Reg. Analysis . .	13·5	2·5	4·5	....	. ..	. ..	....
18-3-48	Sample Analysis	14 1	4.4	5.2				. ..
	"Western" Chickstarter—							
.	Reg. Analysis	†16 0	†3 0	*4.5			1 5	....
9-9-47	Sample Analysis	15.3	4.13	4.45		....	1 54	....
. .	Reg. Analysis	14·5	3·0	4·5				
17-3-48	Sample Analysis	15.6	3.7	4.5				....
	"Western" Eggfood—							
	Reg. Analysis	†40.0	†6.0	*4.0	.		1.5	. ..
21-10-47	Sample Analysis	26·2	6.3	1.9			1.64	. ..
17-3-48	Sample Analysis	28.6	11.4	3.0			1 8	. ..
.	"Western" Laying Mash "A"—							
	Reg. Analysis .	†12.0	†3.0	*7.0	0.5		1 5	. .
8-3-48	Sample Analysis	14.45	3.4	4.7	0 3		0 2	. ..
	"Western" Lin Meal—							
	Reg. Analysis	†25.0	†5 0	*7.0			1 5	....
24-10-47	Sample Analysis	20 4	6 9	5.5	. .		0 71	.
16-3-48	Sample Analysis	22.5	7.9	5.8			0 15	...
	Davis Gelatine (Aust.) Pty., Ltd.							
	"Tricalos" Sterilised Bone Flour—						CaO.	
	Reg. Analysis .	†5.0		.	. .	32 5	40 0	.. .
27-4-48	Sample Analysis	6 8	. .	. ..	.	30 6	40 6	. ..
	Kirkby, C. A. & Sons.							
	"KB" Poultry Mash—							
	Reg. Analysis	†13 0	†3.45	*7.0	0.26	1 21	0 10	. ..
29-10-47	Sample Analysis	14 6	4 3	6.8	1.08	1.71	0.62	. .
	J. Kitchens & Sons Pty., Ltd.							
	"Apollo" Meatmeal—							
...	Reg. Analysis .	†40.0	*11 0	*1.5	..	14 0		. .
29-10-47	Sample Analysis .	45.7	11.0	0.5	.	13.7		. ..
	Logie Sons & Duncan.							
	"Champion Bay" Crayfish Meal—							
	Reg. Analysis	†25.0	*10 0	*6.5				
5-5-48	Sample Analysis	30.4	0.9	9.8	.			
	Milne, W. H. & Co.							
	"Millers" Chickstarter—						CaO.	
	Reg. Analysis .	†15 06	†4 34	*6 1	1.09	1 84	3 11	....
9-9-47	Sample Analysis	15.10	5 14	5.30	0 51	1 72	1 72	
	"Millers" Laying Mash—							
	Reg. Analysis	†14.0	†3 04	*5.5	1.5	1 84	2 58	. .
12-3-48	Sample Analysis .	13.9	4 4	5.2	0 8	1 79	2 57	. ..
	State Abattoirs.							
	"State Abattoirs, Midland" Meatmeal—							
	Reg. Analysis .	†51 0	14 0	*2.0				....
31-3-48	Sample Analysis	48.1	24.0	3.5			.	...
	Thomas, W & Co. (W.A.), Ltd.							
	"Thomas" Bonemeal—						CaO.	
	Reg. Analysis	†10.0	†2.0	*3.5	.	†20 0		...
16-4-48	Sample Analysis	14.9	15.1	2.8		24 56		
	"Thomas" Calf Milk—							
	Reg. Analysis	†13.5	†2.5	*6.0	*1.25	.	*10.0	. ..
8-4-48	Sample Analysis	17.4	5.5	2.7	1.51		4.34	. .
	"Thomas" Chick Grower—							
	Reg. Analysis .	†13.5	†2.5	*6.0	*1.25		*3.75	. .

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
29-10-47	Sample Analysis	14.9	4.2	5.6	1.36	....	3.51	....
8-4-48	Sample Analysis ..	15.3	4.3	4.5	1.21	....	3.42	....
	"Thomas" Chickstarter—							
	Reg. Analysis	†14.5	†2.5	*6.0	*1.25	....	*3.75	....
9-4-48	Sample Analysis	17.6	5.0	4.0	1.40	...	3.87	....
	"Thomas" Chickstarter No. 2—							
..	Reg. Analysis .	†11.0	†1.5	*6.0	*1.25		*3 75	
10-9-47	Sample Analysis	10.80	2.43	3.98	1.32	.	1.75	..
	"Thomas" Egg Milk—							
...	Reg. Analysis	†15.0	†3.0	*4.0	*3.0	....	*15.0	....
9-4-48	Sample Analysis .	20.7	4.6	1.7	3.5	....	7.0	..
	"Thomas" Fattening Mash—							
...	Reg. Analysis ...	†10.0	†2.0	*6.5	*1.5	..	*3.75	..
22-4-48	Sample Analysis ..	12.4	2.5	4.2	1.32	..	1.9	..
	"Thomas" Laying Mash No. 1—							
	Reg. Analysis	†14.0	†2.5	*6.0	*1.5	..	*3.75	..
18-9-47	Sample Analysis .. .	16.1	3.3	4.6	1.4	..	3.34	.
22-10-47	Sample Analysis	15.7	3.6	5.1	1.4	....	3.7	..
12-3-48	Sample Analysis ...	16.1	3.7	4.5	1.9	...	3.95	.
	"Thomas" Laying Mash No. 2—							
...	Reg. Analysis	†11.0	†2.5	*6.5	*1.5	..	*3.75	...
8-3-48	Sample Analysis	13.9	5.0	4.6	1.8	..	2.34	..
	"Thomas" Quicklay—							
.	Reg. Analysis	†35.0	*10.0	*4.0	*1.5	..	*15.0	...
21-10-47	Sample Analysis ..	39 9	11.7	1.5	1 3		16.2	...
16-3-48	Sample Analysis	32.4	8.1	1.7	2.8	.	16.1	
	"Thomas" Sweet Cow Food—							
	Reg. Analysis ..	†9 0	†1.5	*15.0	*1.5	.	*4 0	
22-10-47	Sample Analysis	9.8	2.5	11.3	1.7		2.0	
	Tropical Traders, Ltd.							
	"Evelyn" Calf Food—							
....	Reg. Analysis .	†10.75	†4.77	*3.86	2.89		.	..
13-4-48	Sample Analysis ...	10.5	1.5	2.2	3.24	...	.	..
	"Evelyn" Horse Food—							
								Sulphur
....	Reg Analysis	†12.87	†5.64	†7.14	5.09	1 01	1.54	1 84
1-4-48	Sample Analysis .	12 6	6.2	4.2	5.96	0.83	1.49	0.57
	W.A. Meat Export Works, Robbs Jetty.							
	"WAME" Bonemeal—						CaO.	
....	Reg. Analysis	†18.75	....	...	*.25	†26.0	†27.0	....
12-3-48	Sample Analysis ..	25.2	...	.	.32	24.7	32.2	...
	"WAME" Meatmeal—							
.	Reg. Analysis . .	†45.0	*13.0	*2.0	.		.	....
17-3-48	Sample Analysis ...	44.5	16.9	1.9	...		.	....
	Westralian Farmers Co-op., Ltd.							
	"Red Comb" Chick Pellets "A"—						$CaCO_3$.	
...	Reg. Analysis	†15.0	†4.0	*7.0		...	....	....
26-4-48	Sample Analysis ..	17.0	4.7	4.2	.	....	...	....
	"Red Comb" Laying Pellets, No. 1—							
	Reg. Analysis	†14.0	†4.0	*7.0	0.5		2.5	....
21-10-47	Sample Analysis	12.0	3.1	4.1	0.9	...	3.0	....
26-4-48	Sample Analysis ...	13.1	3.5	3.4	....	.	2.6	....
	"Wesfarmers" Chick Mash "A"—							
	Reg. Analysis	†15.0	†4.0	*7.0	....	....	1.0	....
28-4-48	Sample Analysis	16.8	4.7	4.1	....	....	1.2	....
	"Wesfarmers" Chick Mash "B"—							
..	Reg. Analysis	†14.0	†4.0	*7.0	....	...	1.5	....
26-4-48	Sample Analysis	16.3	4.4	4.1	....	...	1.3	..
	"Wesfarmers" Growers Mash—							
...	Reg. Analysis	†13.0	†4.0	*7.5	0.5	...	2.0	....
26-4-48	Sample Analysis	12.8	3.2	4.4	0.8	...	2.3	....
	"Wesfarmers" Calf Food—				less than		less than	
..	Reg. Analysis	†13.0	†3.5	*6,0	1%	..	2%	...
22-3-48	Sample Analysis	15.4	4.9	5.2	0.5	....	1.37	....
	"Wesfarmers" Laying Mash No. 1—							
....	Reg. Analysis	†14.0	†4.0	*7.0	0.5	....	2.5	....
11-3-48	Sample Analysis	13.7	3.4	3.6	1.1	....	1.5	....
	"Wesfarmers" Protein Meal "B"—							
....	Reg. Analysis	†35.0	†7.0	*4.5	....	....	15.0	....
21-10-47	Sample Analysis	33.8	9.7	1.8	....	....	16.1	..

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime	Others.
		%	%	%	%	%	%	%
15-3-48	Sample Analysis	37.8	7.8	2.0	....	....	11.4	....
	"Wesfarmers" Sweetened Dairy Meal—							
	Reg. Analysis	†11.0	†2.5	*6.0	1.0	...	....	Copper .003
6-11-47	Sample Analysis	10.2	3.8	13.5	1.7	...	...	.014
	Wright, F. W. & Co.							
	"Pannifex" Poultry Pusher—							
	Reg. Analysis	†32.0	†7.0	*8.0	Trace	....	$CaCO_3$. Trace	
16-3-48	Sample Analysis	34.6	8.0	8.9	4.6	...	3.1	....
	Taylor, J. L.							
	"Speedy" Meatmeal—							
...	Reg. Analysis	†38.0	*14.0	*5.0	0.5	15.0	CaO. 21.0	....
10-3-48	Sample Analysis	29.1	16.2	1.0	0.3	19.1	24.8	....
7-4-48	Sample Analysis	27.5	16.0	1.2	0.3	19.0	24.2	....
	Young, R. B.							
	"Morlay" Chickstarter—							
...	Reg. Analysis	†15.0	†3.0	*6.0	1.0	2.0	5.0	....
21-4-48	Sample Analysis	17.8	5.9	3.3	0.96	2.8	2.6	....
	"Morlay" Growing Mash—							
	Reg. Analysis	†13.0	†3.0	*6.0	1.0	2.0	4.0	..
22-10-47	Sample Analysis	12.7	3.1	4.3	0.9	2.2	2.3	...
21-4-48	Sample Analysis	13.8	3.4	3.3	1.08	3.9	5.0	....
	"Morlay" Laying Mash—							
	Reg. Analysis	†14.0	†3.0	*6.0	1.5	2.0	3.0	.
22-10-47	Sample Analysis	14.1	3.2	4.6	1.3	2.9	4.1	..
10-3-48	Sample Analysis	14.5	4.8	3.6	1.3	3.0	4.5	....

*Maximum. †Minimum.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA

Vol. 25. (Second Series) SEPTEMBER, 1948 No. 3

REQUIREMENTS IN DESIGNING THE LAYOUT OF AND BUILDINGS FOR A POULTRY FARM

By E. LOVEGROVE, Chief Poultry Adviser and S. FROOME, Inspector.

THE poultry house is an important factor in the practice of poultry husbandry. If the poultry house is not designed from the standpoint of saving labour, sanitation may become so difficult for the farmer that, notwithstanding good intentions, he will fail to carry out the essential practices.

Climatic conditions vary so widely that no particular type of poultry house can be suggested as desirable for all conditions. Much research work on poultry housing is needed before facts instead of opinions can be presented.

However, there are certain essential requirements for any good poultry house. They are (1) convenience (2) durability coupled with low capital cost (3) ample ventilation (4) comfort in quarters and equipment (5) provision for ample light and direct sunlight and (6) sufficient space for the desired number of birds to be kept. Perhaps the last mentioned essential is more a matter of management. Many poultrymen crowd too many birds into a good poultry house and thus it does not meet the requirements for the maintenance of the health of the poultry flock.

The location and design of the buildings on a poultry farm should receive as much thought as a successful business man would give to the planning of a proposed new factory. In both cases location and site are of prime importance to avoid commencing with unnecessary handicaps in a business which has to sell its products in the world's markets.

LOCATION OF LAND.

In Western Australia the poultry population is mainly concentrated in three areas:—The wheatbelt, land adjacent to portions of the Great Southern railway and the greater metropolitan area. The basic reasons for these fairly well

defined areas are—The wheatbelt provides the main feeds for poultry, i.e., wheat, bran and pollard; The Great Southern area because of its climate and nearness to the wheat supplies; and the metropolitan area because of its proximity to markets and to social amenities, i.e., electricity, water supply, good roads and transport. The obvious location for the poultry industry is in the centre of the flour milling industry when it is realised that a farm carrying 1,000 layers requires about 75 tons of supplies during the year. The unimproved value of land varies considerably with the district in which it is situated. The average cost of land in a country district 60 to 100 miles from Perth would be £5 per acre, but the price in the metropolitan area would be from £10 to £25 per acre according to its situation relative to social amenities.

The factors that have been enumerated are the salient points which should be considered when the location of the future poultry farm is being decided.

SELECTING A SITE.

Suitable sites for poultry farming can be found in almost any district, but the drawbacks resulting from a bad site will be a serious handicap to success. The ideal site is, perhaps, seldom obtained, but land which approximates this ideal should be chosen and the layout planned to suit the conditions.

The main essentials are—

Accessibility for obtaining supplies and marketing produce, i.e., proximity to good roads, and near electricity supply lines.

Adequate water supply should be obtainable.

Area should be at least five acres to allow for raising young stock, growing green feed and provide for later expansion.

High ground is preferable, with a slight slope facing the east or north-east.

The slope should provide natural drainage, but too steep a gradient will be found to involve greater expense in buildings and may cause soil erosion.

The surface of the land should not be too broken or uneven. The best class of soil is sand or sandy loam but many successful poultry farmers are keeping fowls on various types of light soil.

A windbreak of trees is desirable for protection from cold winds, and shade is beneficial in summer, but the houses should not be built within a dense enclosure of trees that would stop summer breezes or shade the houses from winter sunshine.

PLANNING THE FARM LAYOUT.

It is not possible to describe the exact layout for a poultry farm because the shape of the block and its contour govern the plan, but there are certain basic requirements which can be enumerated.

Before any buildings are erected a plan should be prepared showing the farm as it would appear when fully developed. Portions of this planned layout could then be built as required with the knowledge that it was part of a concerted whole.

A point which cannot be too strongly stressed is that buildings of a well built and permanent character should be constructed. Building a poultry farm on those lines creates an asset which will be valuable many years after construction. Poultry farming should not be considered as a "get rich quick" proposition but rather as a way of life and the improved farm a permanent asset to be handed to the next generation. Furthermore, a well laid out and well constructed farm will always be saleable at a figure much in excess of one which is lacking in this respect. Another salient point is the present tendency to keep a large number of birds on a small area. The well known axiom of the Health Authorities "The more dense the population per acre the higher the possible incidence of disease" should be applied to poultry farms. More reports of disease are being received every year and many of them can be traced to infected soil, overcrowding and failing to plan the farm so that the yards can remain vacant in rotation.

The essential requirements of a well planned farm are—

1. The residence should be near the road and securely fenced in with a 6 foot wire netting fence so that the garden will be free from stray poultry. As far as finances will allow, conveniences to assist the housewife in her duties should be provided. The house has been mentioned before farm buildings because good living conditions contribute in a large degree to the ultimate success of the farm.

2. Owing to the constant attention that has to be given, not only in the day but during the evening, to incubators and brooders in the rearing season, it is good planning to have the incubator room and brooder house reasonably close to the dwelling. When a building has to be visited many times a day the distance to be travelled should be as short as possible. This leads to not only more economical but also to more efficient working.

3. The feed house with its chaffcutter, feed mixer, and grister is the distributing centre for the farm and as such, should occupy a position which will conserve time, labour and distances to be walked when feeding and cleaning.

4. Roads and lanes from the feed house to the different sections of the farm should be laid out giving special consideration to working convenience. Every detail that will save time and labour is important. The cumulative wastage of effort on a badly planned farm over one year would be enormous and would reduce the efficiency of the owner.

5. No road or lane should be less than 21 feet wide to allow of the use of vehicles for feeding and cleaning. This arrangement also prevents the close groupings of buildings, ensures a free circulation of air, and assists in the isolation of the different units should an outbreak of disease occur.

6. The section of the farm on which young stock is raised should be completely separated from the adult fowl runs and should be on higher ground so they will not be subject to the drainage from the adult birds. For successful rearing these grounds require complete resting from the end of one rearing season until the commencement of the next, and could be cultivated and a green crop planted. Of recent years it has been proved conclusively that young stock will

not thrive in yards which are used all the year round, but require what has become known as "new" ground, that is, under practical conditions "rested" ground.

7. All sheds which are intended to house poultry should face the east or north-east so that the rising sun will shine into every part of the shed. In winter this is most valuable to dry and warm the interior when the early mornings may be cold and damp for birds respond to comfortable conditions in their house. Sunlight is one of nature's disinfecting agents and helps to prevent colds and other disease attacking the flock. Probably the most severe winds come from the north-west and these would strike the poultry house on the back wall. Protection from cold winds is vitally necessary as nothing lowers egg production so much as this type of exposure.

8. As young succulent green feed forms about 50 per cent. of the poultry ration, the area reserved for growing green crops and the irrigation system which accompanies it must receive due consideration. The basic requirement in this section of the farm is the ability to produce a continuous and plentiful supply of green feed.

The preceding pages have been written to assist the person who is proposing to enter the poultry industry in the initial stages of his venture, so that he will not acquire unsuitable land. Furthermore, it is hoped that good planning will eliminate much of the drudgery attached to haphazard poultry farming, will give the farmer a better return for his labour and make him a contented and permanent poultry husbandman.

FEED ROOM, VEHICLE SHED AND EGG ROOM.

This is one of the sheds on the farm which should never house a bird and, therefore, the aim will be for a modern and well equipped building with labour saving devices. It cannot be substantiated that there is any one "best" design for this building, but for Western Australian conditions there are a few points worthy of consideration.

If the egg room is placed on the southern end it will be the coolest part of the building during the summer months. Again, if a person is to work in reasonable comfort and without unnecessary fatigue, it should not be a low type of shed but have walls 10 feet high and a gable roof. For efficient work good light is wanted, therefore, sufficient window space must be built into the walls. Figure 1 shows a suggested design which should fulfil the requirements for this building, and because of its simple construction should not be excessively costly to erect. It is suggested that the walls should be timber framing covered with asbestos cement sheets, but cement bricks or concrete walls are more durable and provided the work is done by the poultry farmer should not be much more expensive.

It will be noted that the garage for the motor truck is so arranged that the loaded truck can be driven close to the back of the feed bins and feeding materials can be tipped into the bins direct from the truck. The loading or unloading of egg cases can take place with the truck under cover, and this is

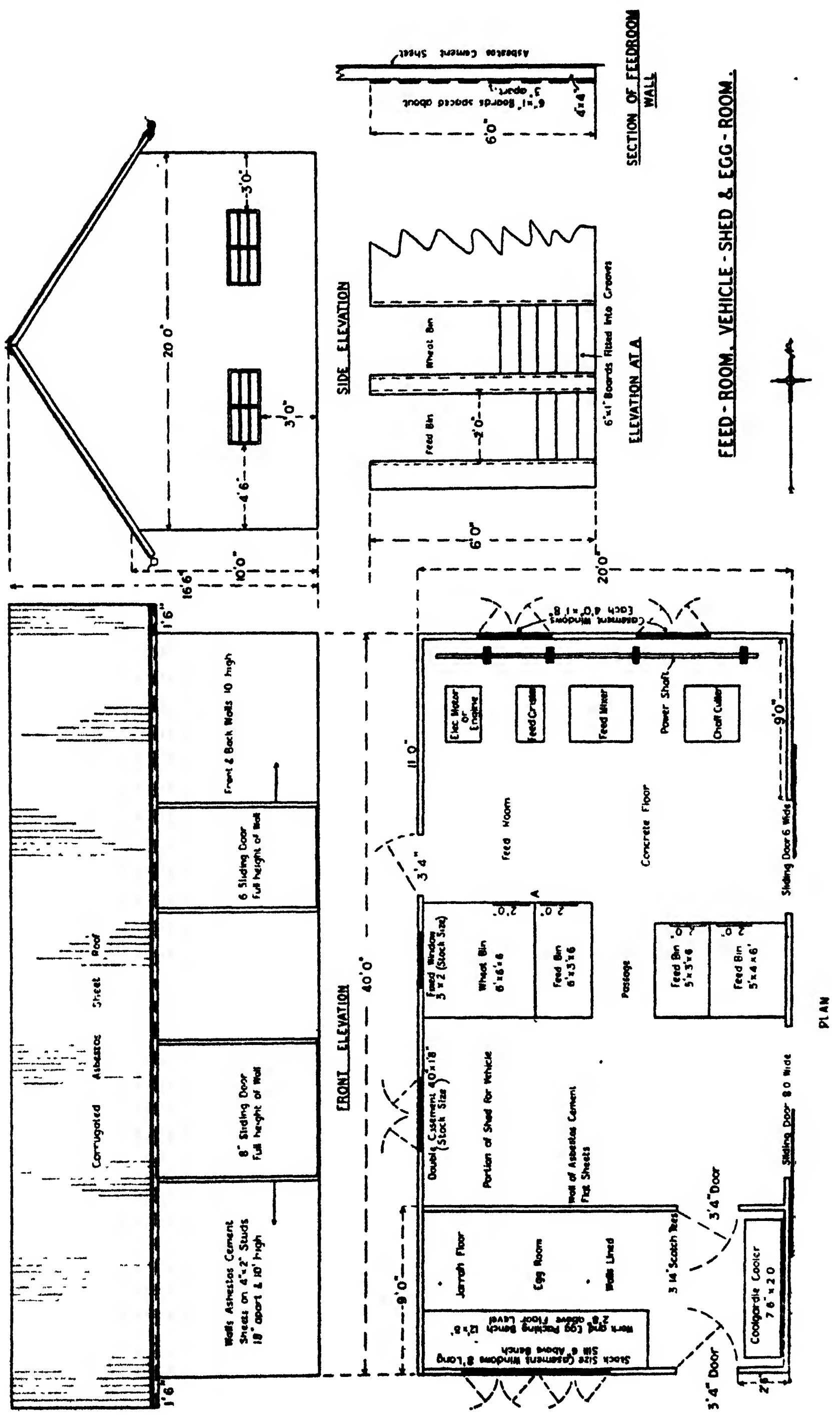

FEED-ROOM, VEHICLE-SHED & EGG-ROOM.
SIDE ELEVATION
FRONT ELEVATION
ELEVATION AT A
SECTION OF FEEDROOM WALL
PLAN
Corrugated Asbestos Sheet Roof
Walls Asbestos Cement Sheets on 4"×2" Studs 18" apart & 10' high
8' Sliding Door Full height of Wall
6' Sliding Door Full height of Wall
Front & Back Walls 10' high
Asbestos Cement Sheet
6"×1" Boards spaced about 3" apart
6"×1" Boards Fitted into Grooves
Wheat Bin
Feed Bin
Feed Room
Concrete Floor
Power Shaft
Elec Motor or Engine
Feed Crusher
Feed Mixer
Chaff Cutter
Casement Windows Each 4'0"×1'8"
Sliding Door 6' Wide
Sliding Door 8' 0" Wide
Passage
Portion of Shed for Vehicle
Wall of Asbestos Cement Flat Sheets
Egg Room
Jarrah Floor
Walls Lined
Coolgardie Cooler 7'6"×2'0"
3'4" Door
20'0"
40'0"
16'6"

Fig 1.

important in the hot weather when it is essential to keep the eggs as cool as possible to preserve their quality. The different units in the feed room have been placed in their most convenient positions; the feed grister opposite the wheat bin; the feed mixer equidistant from the feed bins and the chaffcutter near the door where the green feed would be deposited.

The egg room, which is the southern portion of the building, is provided with a long window above the work bench. To ensure clean conditions for the storage, handling and packing of the eggs, the room is ceiled, lined and floored. A jarrah wood floor is suggested in the illustration because a wooden floor gives better working conditions to the packer, but a concrete floor with a "duck board" along the front of the bench is satisfactory. Space has been allotted in the egg room for a "Coolgardie cooler" as this appears to be a satisfactory method of keeping eggs cool on the farm. The detail of the wall of this feed room shows the method of protecting the asbestos sheets forming the wall, by fixing 6in. x 1in. boards to the studs. Without some protection it is most probable that the wall would be damaged within a short period.

The entrances into the feed bins are fitted with board which can be removed as the feeding material in the bin is used. The size of the wheat bin is 6ft. x 6ft. and this will hold approximately 5.2 tons of bulk or 65 bags of wheat.

HOUSING THE LAYING FLOCK.

The most popular system of housing laying birds in Western Australia is by means of the semi-intensive laying shed. This system appears to be quite suitable for the climatic conditions; the birds have large yards to use in the warm weather, and the sheds are large enough to keep the birds confined during period of inclement weather.

Four sheds of the type recommended by this Department will provide accommodation for 1,200 layers. Each shed is 64ft. x 16ft. and is divided into two equal portions; each portion will comfortably house 150 laying birds. It has been found in practice that units of 150 birds can be economically handled, being small enough in case of an outbreak of disease, and yet not too small to make the labour involved too expensive. A suggested layout for the sheds using the double yard system, is shown in Fig. 2.

Many commercial poultry farms near Perth have been established on land which is too small for the purpose; consequently, when the poultry farmer increased his flock he has been forced to have a high concentration of stock per acre, with the resultant higher incidence of disease. The principles of poultry husbandry indicate that not more than 1,000 birds to the acre should be kept under the semi-intensive system and the suggested layout in Fig. 2 conforms to that requirement. The double yard system allows each yard to be empty for six months, the yard ploughed and a green crop grown. The birds would be running on fresh ground every six months and with this arrangement the soil should not become contaminated. It will be noticed that each double unit of 300 birds is housed separately, and should an outbreak of disease occur it is possible to completely isolate any unit by closing the yards surrounding that unit.

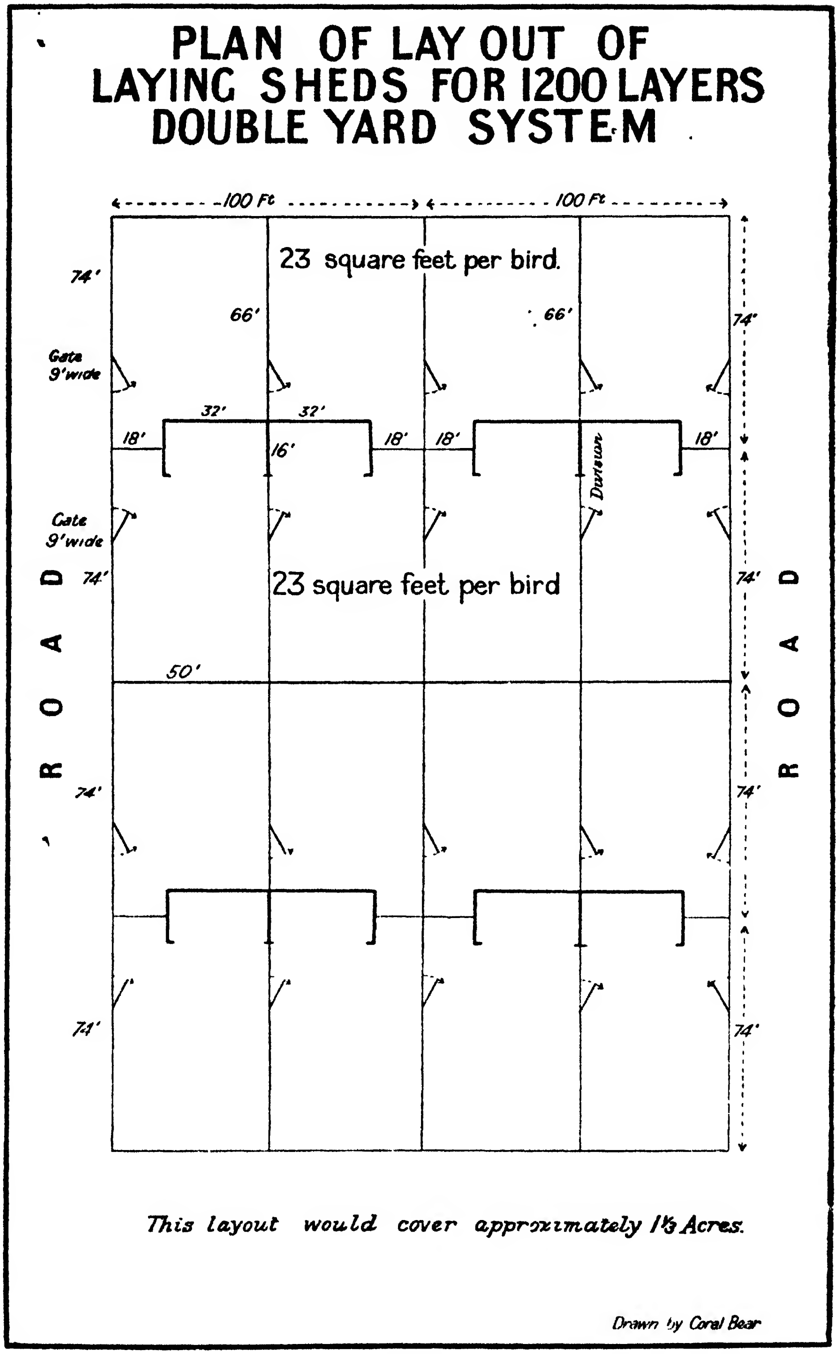


Fig. 2.

Quick servicing of the laying flock is made possible by the wide gates in each yard which allow a vehicle to be taken around the sheds and the feeding done in one trip from the feed shed.

THE SEMI-INTENSIVE LAYING SHED.

Figure 3 is the ground plan of one half of a laying shed, that is, a portion 32ft. x 16ft. capable of housing a unit of 150 layers. The second portion of the shed is a repetition of the part shown in the plan. Figures 4, 5 and 6 show the construction of the shed and are self-explanatory, but there are a few special points which should be noted.

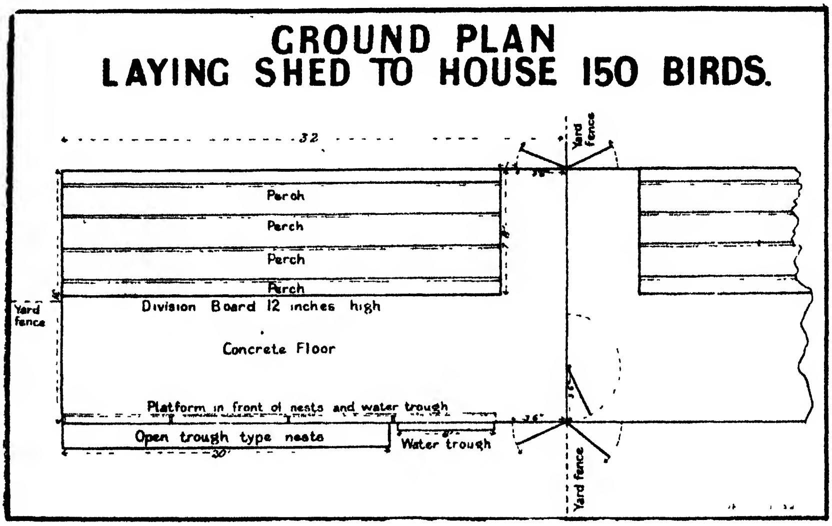


Fig. 3.

It is essential that the surface of the concrete floor should be at least 4ins. above the ground level to ensure that the floor will be dry during wet weather. It has been found that erecting the framework of the shed on the top of a concrete wall standing 6ins. above the floor level makes a substantial foundation, keeps the litter in position and facilitates efficient cleaning. At the top

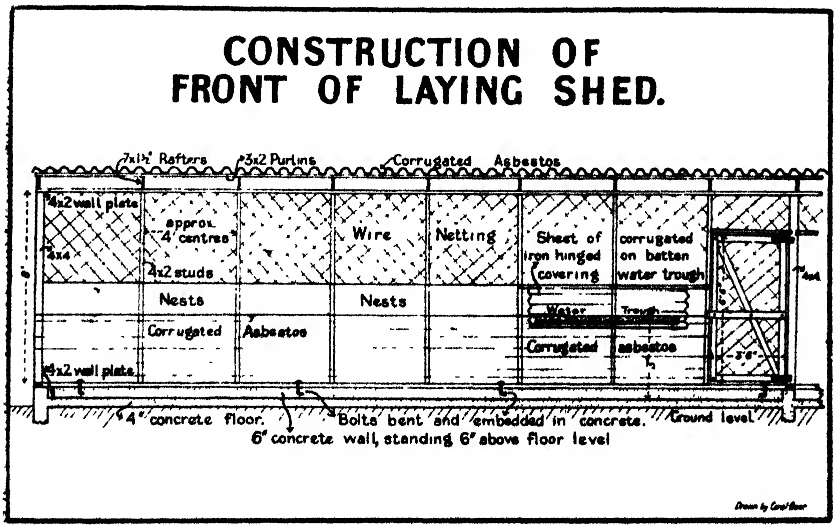


Fig. 4.

of the back wall the space between the wall plate and the purlins provides ample ventilation, but the board supporting the gutter prevents rain driving into the shed. The lower half of the back wall of the shed should be wire netted to confine the birds in the shed when the flaps are lifted during hot weather.

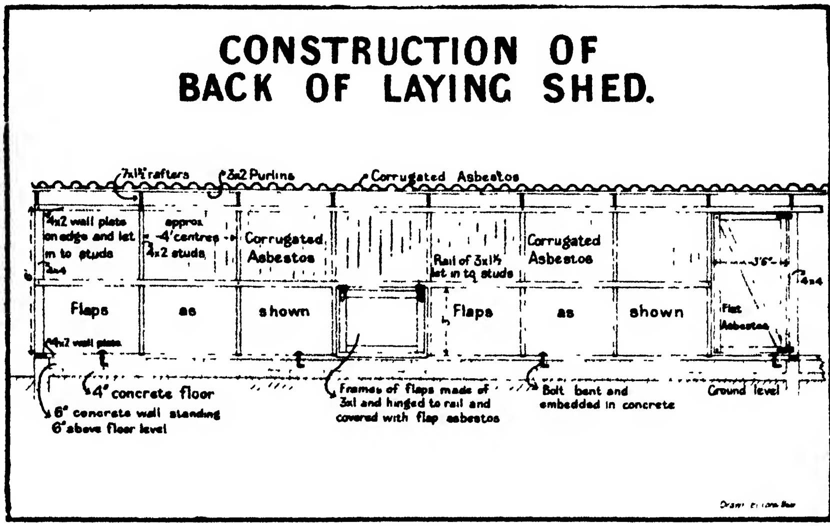


Fig 5.

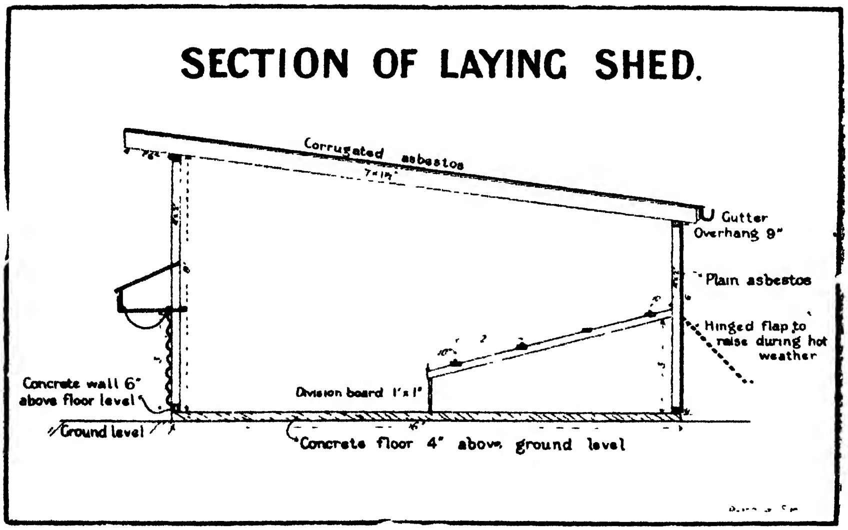


Fig. 6.

The nests and the water trough are on the outside of the front of the shed, but the birds approach these by a platform running along the inside of the shed at the same level. The birds have access to the water through a long narrow opening cut in the wire netting covering the front of the shed. The nests are simple troughs, each trough being approximately 3ft. 8ins. in length, 1ft. 3ins. wide at the top and 11ins. in depth. The trough is divided into three equal sections by two wooden divisions so that the top of each nest

is 1ft. 3ins. by 1ft. 2ins. Each trough rests on 3in. x 1in. battens and can be removed for cleaning by lifting out between the studs supporting the front of the shed. Details of the construction of the nest are given in Fig. 7.

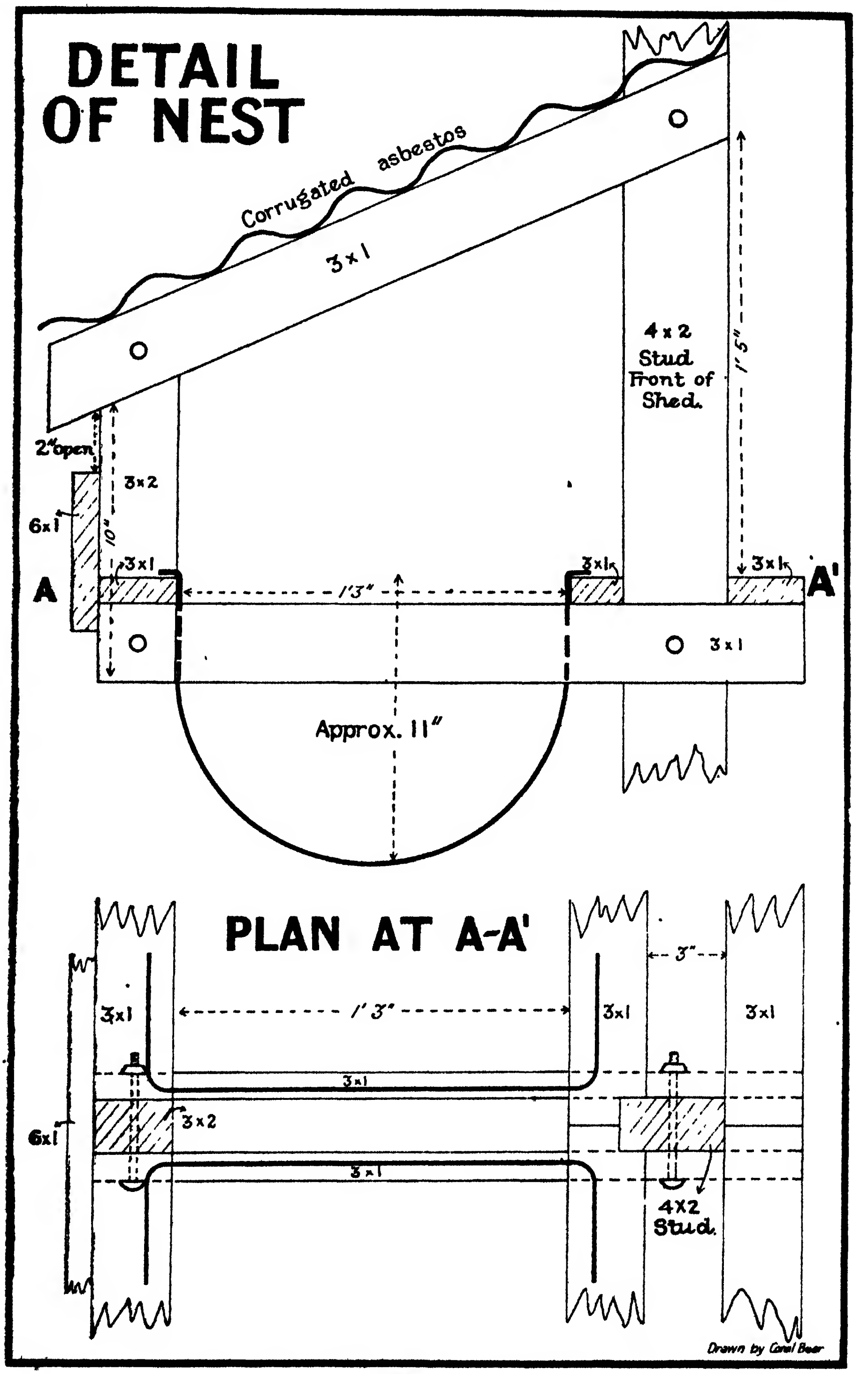


Fig. 7.

It is an advantage to construct the platform in front of the nests in such a manner that it is hinged to the shed and can be lifted up to cover the opening into the nests and so prevent birds roosting on it or in the nests at night time.

Figure 6 clearly shows that the ladder type of perch is recommended for these sheds. The bearers supporting the perches are hinged to the studs of the back wall by a bolt which allows the entire set of perches to be raised and fastened to the rafters during cleaning operations. Wire netting should be fastened to the underside of the perch bearers to prevent the birds getting to the manure below the perches.

THE INTENSIVE LAYING SHED.

As previously stated, the most popular system of housing the layers in Western Australia is the semi-intensive method, but throughout Australia there are a small number of intensive sheds. The birds are housed in one large shed; yards are not provided and the birds are not exposed to varying weather conditions. Provided the pens and nests were kept in a clean condition, this system should produce clean eggs.

Figures 8 and 9 are outline plan and sketches of an intensive shed to house 1,200 layers. The shed is divided with wire-netting partitions into compartments to hold 50 to 60 birds allowing approximately four square feet of floor space to each bird.

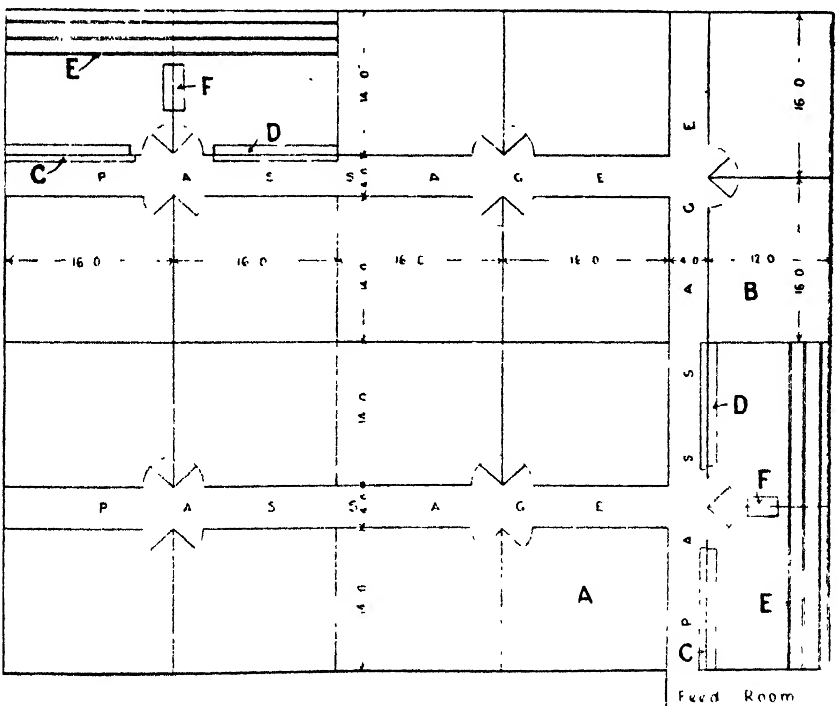


Fig. 8.—Outline plan of intensive shed. (A) Compartment for 62 layers. (B) Compartment for 52 layers. (C) Water and feed troughs. (D) Nest boxes 24 inches above floor level. (E) Perches. (F) Dry feed hoppers.

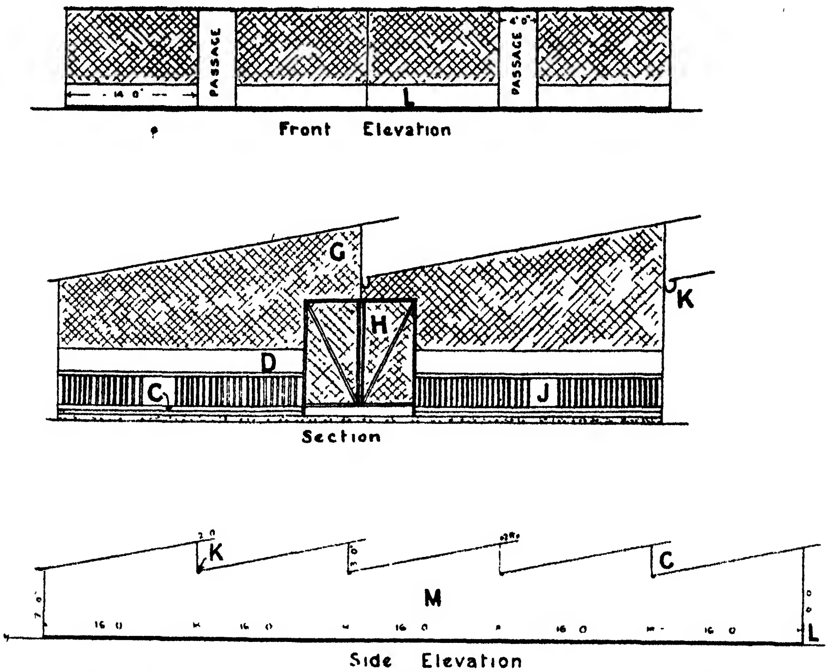


Fig. 9.—Intensive shed, front and side elevation and section. (C) Water and feed troughs. (D) Nest boxes 24 inches above floor level. (G and H) Wirenetting. (J) Wooden slats above a 6 inch board. (K) Gutter. (L) Corrugated iron sheet on edge. (M) Sides of shed totally enclosed.

This type of building has two salient points—the work of feeding, cleaning and collecting eggs is all done under cover and as the poultry farmer increases his flock further sections can be added to the front of the existing building. Good management is necessary to make a success of this system of poultry keeping. The operator must be always alert and watch for any sign of deterioration in his flock and he must be skilful and careful in feeding the layers to maintain high production.

It is the usual practice with the sawtooth type of intensive shed to commence by building two sections. The back section consists of four pens, each capable of housing 52 birds and a four ft. wide passage in front of the pens. This section is often extended at one end for several feet to form the feed room.

The second section as shown in Fig. 8 is divided into four compartments, each 16ft. x 14ft. and each capable of housing 62 birds. It will be noted that the pens are serviced by two passages running at right angles to the original passage. Further extension of the shed is obtained by the addition of sections similar to the second section erected.

The divisions between the pens consist of one sheet of corrugated iron on edge, which prevents ground draughts, and wire netting above.

Figure 9 shows that each section of the shed is 10ft. high in the front and 7ft. at the back. This forms an open space of 3ft. along the top of the front of each section to admit sunlight and allow ample ventilation. The space is wire netted and it protected from the weather by the roof which projects 2ft.

The section in Fig. 9 shows the construction of the pens along each side of the passages.

Figures 10 and 11 are reproductions from photographs in "Poultry Farming" published by the Department of Agriculture, Victoria. Fig. 10 shows a model of a "saw-tooth" type of poultry house and Fig. 11 is a poultry shed on Mr. R. J. Jelbart's farm, Eltham. The front was closed in with a glass cloth, as the front section was being used as a brooder house. (Top photo. page 96 and photo. page 97 "Poultry Farming" Dept. of Agric. Victoria.)

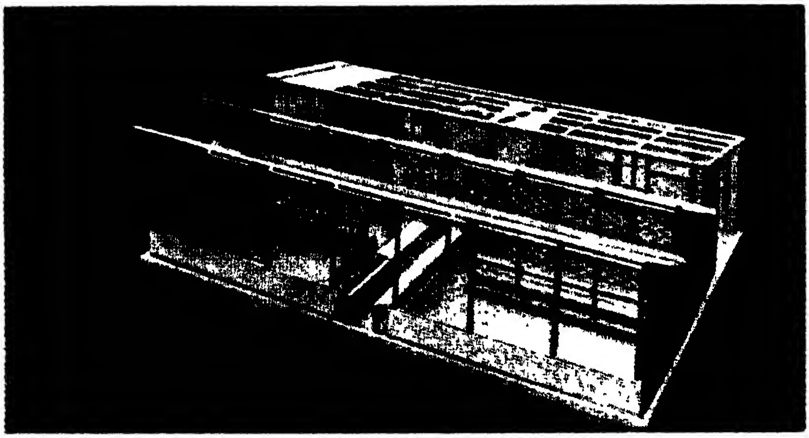


Fig. 10.

LAYING CAGE BATTERIES.

Individual cages for the laying hen have been in use in some countries for several years. In the U.S.A. they have been in use on some poultry farms for over 15 years and it is still debatable whether the advantages can outweigh the disadvantages and if the use of batteries will become popular and permanent. At the C.S.I.R. Poultry Research Centre at Werribee, Victoria, trapnesting, single testing pens, and laying batteries are being used for artificial insemination and recording production. Up to the present, the research officer in charge thinks the batteries are the best.

The size of each individual cage and the number cages in a battery appear to vary considerably, but a survey of several reports indicates that the average size battery is three tiers of cages high (about 6ft.) and 18 to 24 cages long. Each cage is approximately 12ins. wide, 18ins, from front to back and 17ins. high. The floor of the cage consists of wire bars about an inch apart and the droppings collect on trays or on a conveyor belt below the floor. Feed troughs are fixed to the front of the cages, and water is made available by long troughs running the full length of the battery, or, as at Werribee, the cages are fitted with the "Henpex" drinking system. The wire floor slopes to the front and the eggs roll into a tray in the front of each cage.

Laying batteries have a number of advantages: Individual egg production records can easily be kept, the vices of feather picking and cannibalism are eliminated, and early and easy culling is made possible. Owing to the cost of installing the batteries and the culling of many birds because of poor production, it is necessary to have a supply of replacement birds if the battery is to

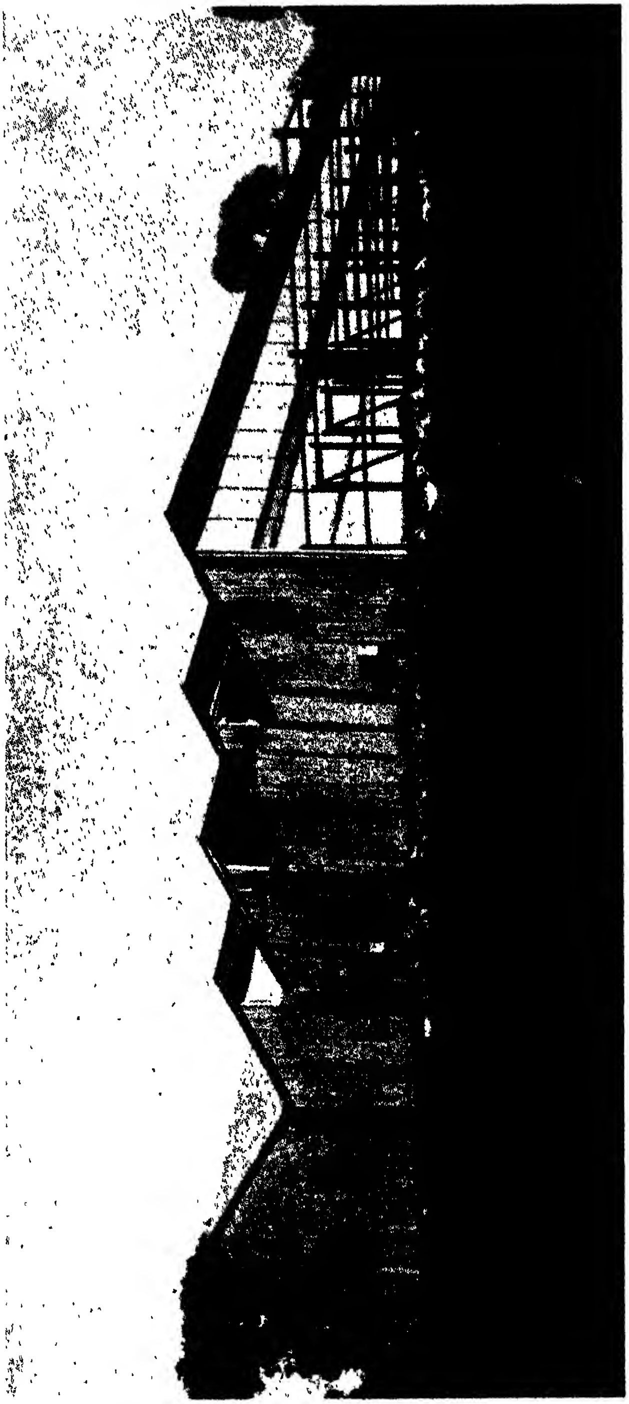


Fig. 11.

be a financial success. No cage should be left empty because the greater the labour requirements for servicing as compared with a semi-intensive shed makes it imperative for every cage to produce its quota of eggs.

Greater skill and care in feeding is required for layers in batteries, but under normal conditions of cleanliness a high percentage of clean eggs, fit for export, should be produced.

THE INCUBATOR AND BATTERY BROODER ROOMS.

To operate an incubator or battery brooder with ease and accuracy, it is necessary to have correct room conditions and many differently constructed rooms will be found satisfactory.

The principal requirements are a reasonably uniform temperature and humidity, and ample ventilation to bring fresh air into the room and remove the used air.

To prevent sudden changes of incubator room temperatures, the room should be ceiled and lined and constructed of material that will not react suddenly to changes of atmospheric temperature. Ventilation can be provided by means of properly arranged windows and by special ventilators. Ventilation assists in temperature and humidity control, more air being needed in warm weather and less in cold weather.

Figure 12 is the outline plan of a building designed to contain an incubator room, a battery brooder room, and a service room. The main entrance to the building is by a 6ft. sliding door "M" into the service room which is 15ft. x 9ft. This room provides storage space for chicken boxes and eggs awaiting incubation and is fitted with a tank "D," 4ft. x 4ft. x 2ft. 4ins., for cleaning and disinfecting incubator trays. The outlet from the tank goes through the wall and empties into a drain. A bench "E," 5ft. x 3ft., adjoins the tank and the top of the bench projects an inch over the tank and slopes slightly toward that end. A louvred winder "H" is immediately above the bench and tank.

From the service room a 4ft. sliding door gives entrance to the incubator room which is 18ft. x 15ft. in size. A room of this size will conveniently house a 6,300 egg capacity incubator "B" and a 2,700 egg hatcher "C" and leave ample space for the work connected with chicken hatching. The room has a concrete floor, is lined and ceiled and a 8ft. x 3ft. casement window "G" above the bench "A" provides good lighting conditions and if necessary, some ventilation. A dark curtain can be drawn across the window when it is desired to darken the room.

The bench "A" is 10ft. long x 3ft. wide and 4ft. from the end a narrow slit in the bench top is fitted with a glass panel. A bright light below the panel allows rapid candling of eggs before and during incubation. So that hygienic conditions can be maintained during chick sexing operations a small metal sink is fitted at the most convenient position on the bench. The outlet from the sink discharges into a drain outside the building and the flow of water carries away the exereta from the chicks being sexed.

A 4ft. wide sliding door "L" connects the incubator room with the battery brooder room which is 15ft. by 9ft. This room is capable of accommodating two 4-tier battery brooders "F," each of which are approximately 6ft. x 2ft. 6ins. The floor is concrete and the room is ceiled and lined, and a casement window "K" gives sufficient light. It is not advisable to have a window in such a

position that sunlight will fall on the battery brooder as it may lead to toe picking and cannibalism. A stock size ledged and braced door "N" leads to the open air.

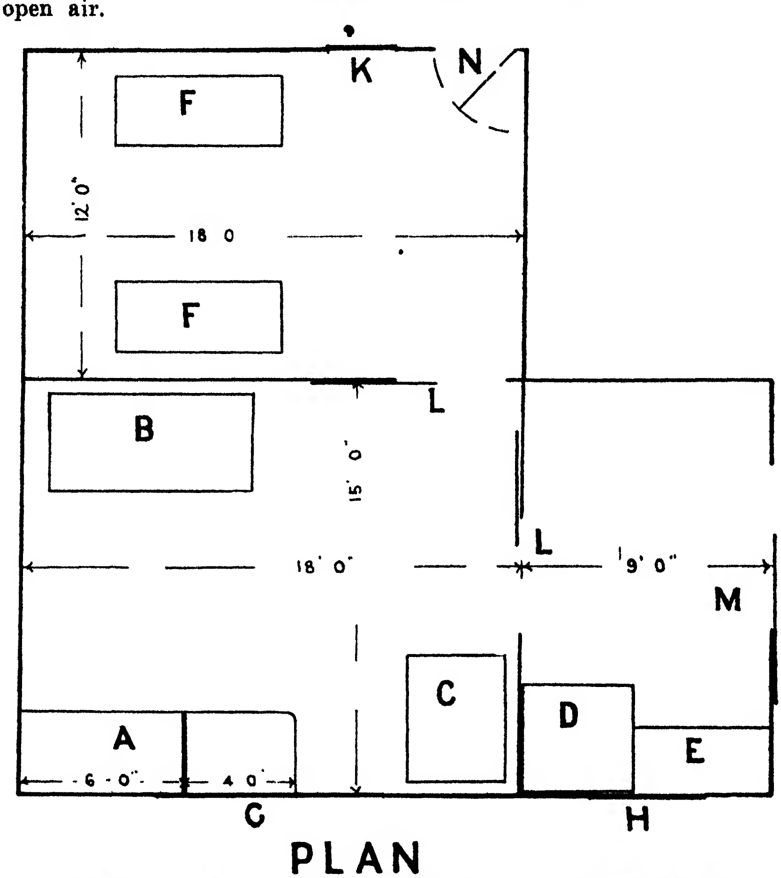


Fig. 12.—Incubator and battery brooder house. (A) Bench fitted with egg candling device. (B) 6,300 egg capacity incubator. (C) 2,700 egg capacity hatcher. (D) Tank for washing and disinfecting incubator trays. (E) Bench 5ft. by 3ft. adjoining tank. (F) Battery brooders. (G) Casement window. (H) Louvre window. (K) Casement window. (L) 4ft. sliding door. (N) Ledged-braced door (stock size).

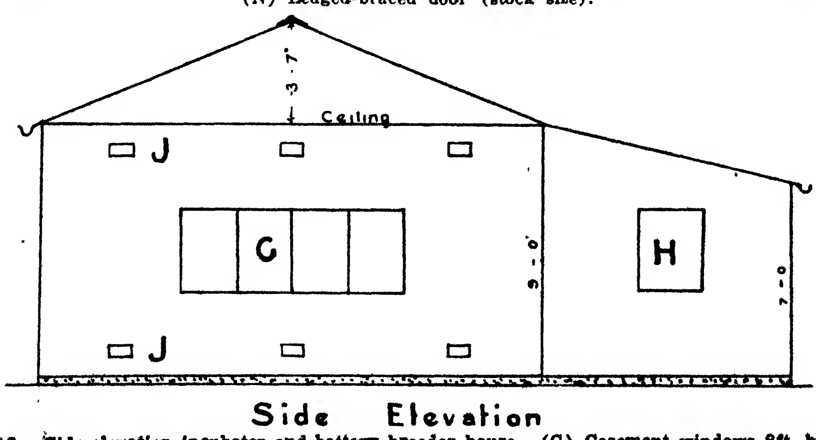


Fig. 13.—Side elevation incubator and battery brooder house. (G) Casement windows 8ft. by 3ft. (H) Louvre window.

Figure 13 shows the side elevation of the building the important point being the arrangement of the ventilators "J" "J" in the incubator room. These are placed as near as possible to the ceiling and floor respectively.

Figure 14 shows the hatcher in the corner of the incubator room on Mr. M. Stocker's "Cavvystock Poultry Farm" at Roleystone. The right hand side of the picture depicts the corner of the bench, a portion of the window above

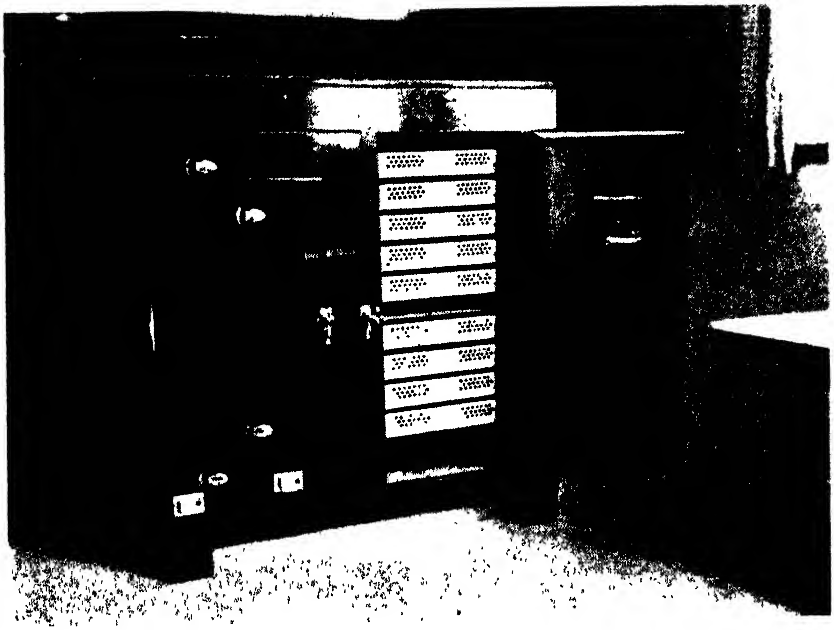


Fig. 14.

the bench and the curtain used to darken the room. The plan of the incubator room given in Fig. 12 closely follows the design of the room in Fig. 14. The substantial build and well finished appearance is clearly shown in the photograph.

THE COLD BROODER HOUSE.

When the chickens leave the battery brooder they should be placed in cold brooders and Figs. 15, 16, 17, and 18 illustrate the type of cold brooder house recommended. Fig. 15 is a plan of the building, which is 46ft. long x 18ft. wide and provides for 10 cold brooders each holding 80 chicks from three to six weeks of age. A passage 4ft. wide along the back of the brooders and another passage 6ft. wide between each set of five brooders, facilitates the servicing of the brooders. Each brooder and section of the brooder house is 4ft. wide and Fig. 16 shows the construction of each division. It will be noted that a sheet of asbestos "A," 4ft. 6in. x 2ft. 6in., forms the division immediately next to the brooder to prevent the possibility of sweeping ground draughts, but the remainder of the divisions and above the brooders is wire netted.

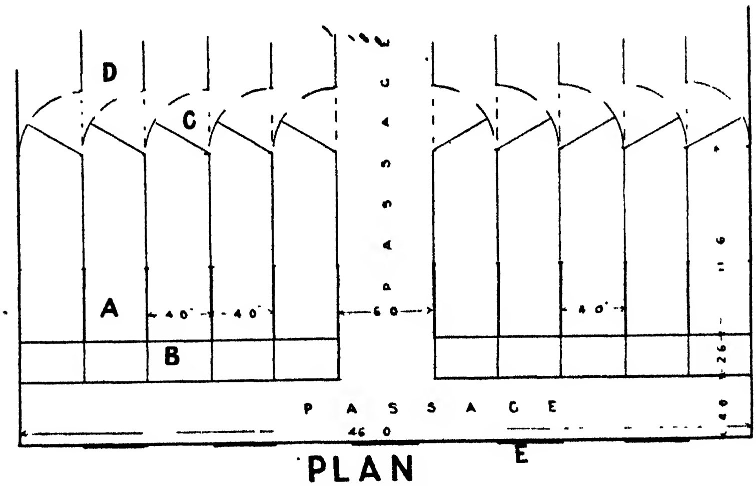


Fig. 15.—Plan of cold brooder house. (A) 4ft. wide section of the brooder house. (B) Series of cold brooders. (C) Wire netted gates leading to outside runs. (D) Outside runs. (E) Stock size windows hinged at top or louvre windows.

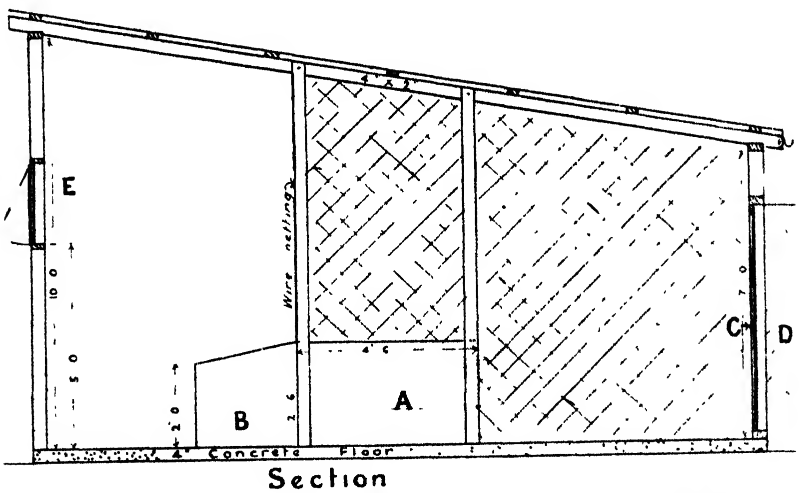


Fig. 16.—Section of cold brooder house. (A) Asbestos sheet to prevent draughts. (B) Cold brooders. (C) Wire netted gates leading to outside runs. (D) Outside runs. (E) Stock size windows hinged at top or louvre windows.

The building is 10ft. high in the front and 7ft. high at the back and is principally constructed of 4in. x 2in. timber. The front and both ends are completely enclosed except that a series of windows are placed in the front wall; the lower edge of the windows "E" being 5ft. above floor level. The floor is concrete raised 4in. above ground level to ensure dry conditions for the chickens. The back of the house is wire netted above the gates "C" which when opened form the gates to the outside runs.

The outside runs "D" should be overhead netted to prevent the destruction of the chickens by crows or other pests.

A description of the construction of the cold brooders is given in leaflet No. 888 which is available at this Department. Fig. 17 shows the exterior of the long cold brooder house on Mr. Stocker's farm and Fig. 18 is a portion of the interior of the same building showing the general arrangement of the internal fittings.

Fig. 17.—Exterior of cold brooder house on Mr. Stocker's farm.

Fig. 18.—Portion of the interior of the cold brooder house.

THE BROODER HOUSE.

The previous sections dealt with the buildings necessary for a battery and cold brooder system of brooding chicks, but if it is desired to use other types of brooders, the design given in Fig. 19 should give satisfaction. Although the sketches show a hot water system, the same type of building would be quite suitable for single unit brooders, either lamp heated, electric, or sawdust burning.

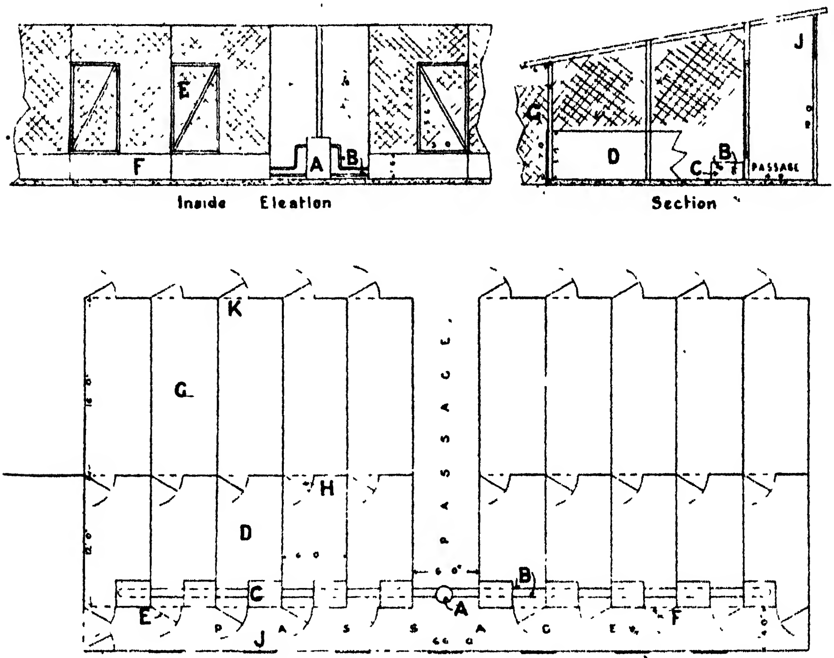


Fig. 19.—Design of a brooder house arranged for a hot water system. (A) Hot water boiler. (B) Flow and return pipes. (C) Box type brooder covering pipes. (D) Inside runs. (E) Wire gates swinging into passage. (F) Asbestos sheeting 1ft. 6in. high. (G) Outside runs. (H) Gates leading to outside runs. (J) Louvre type windows. (K) Gates to outside runs.

The front and both ends of the brooder house are fully enclosed with flat asbestos sheets or other building material, but the back is only enclosed by asbestos to a height of 3ft. above floor level and above that it is wire netted. The gates "H" in the back of the shed, which allow the chickens access to the outside runs "G" open inwards so that chicks coming into the brooder house from the outside cannot become imprisoned behind a gate. The gates are 3ft. wide and the lower half of the gate is covered with flat asbestos. To prevent ground draughts the partitions between the sections in the brooder house are similar to the back of the house, that is, 3ft. of flat asbestos enclosing the lower portion "D" and wire netting above, as shown in the section of Fig. 19.

The series of windows "J" near the top of the front wall ensure good ventilation as well as allowing sunlight to reach the chickens.

The usual arrangement in a hot water pipe type of brooder is for the boiler to be situated at one end of the brooder house, with the result that the portion of the pipe system "B" farthest away from the boiler is always much cooler than the pipes near the boiler. By placing the boiler "A" in the centre of the brooder house, a more even temperature can be maintained throughout the system.

Each section of the brooder house is 12ft. by 6ft. which gives ample room to brood 100 chickens until they are old enough to do without heat and can be removed to the rearing pens. The wire netting gates "E" leading into each section are 5ft. 6ins. x 3ft. and swing outward into the passage. The bottom of the gate is 1ft. 6ins. above the floor level and below this is filled in with flat asbestos "F" which forms the back of the brooder and prevents ground draughts. The building illustrated is 66ft. long x 16ft. wide, is 10ft. in height in the front and 7ft. at the back. The passage along the back of the brooders is 4ft. wide and easy access to the boiler is by a 6ft. wide passage from the front of the house or from the passage in the house. The floor is concrete raised at least 4ins. above ground level to ensure dry conditions.

The outside runs "G" are each 16ft. x 6ft. and should be overhead netted. Gates "K" 3ft. wide and swinging outwards, give entry to the runs.

APPLIANCES FOR THE LAYING FLOCK.

Perching was discussed in the September, 1947 issue of the Journal of the Department of Agriculture, and the information has been printed in leaflet No. 904 which is available at the Department of Agriculture, Perth.

Dry feed hoppers are in use on most poultry farms and there are numerous sizes and types, many of which give satisfaction. Fig. 20 illustrates a dry feeder for adult birds in which the container is a 44 gallon drum. As these

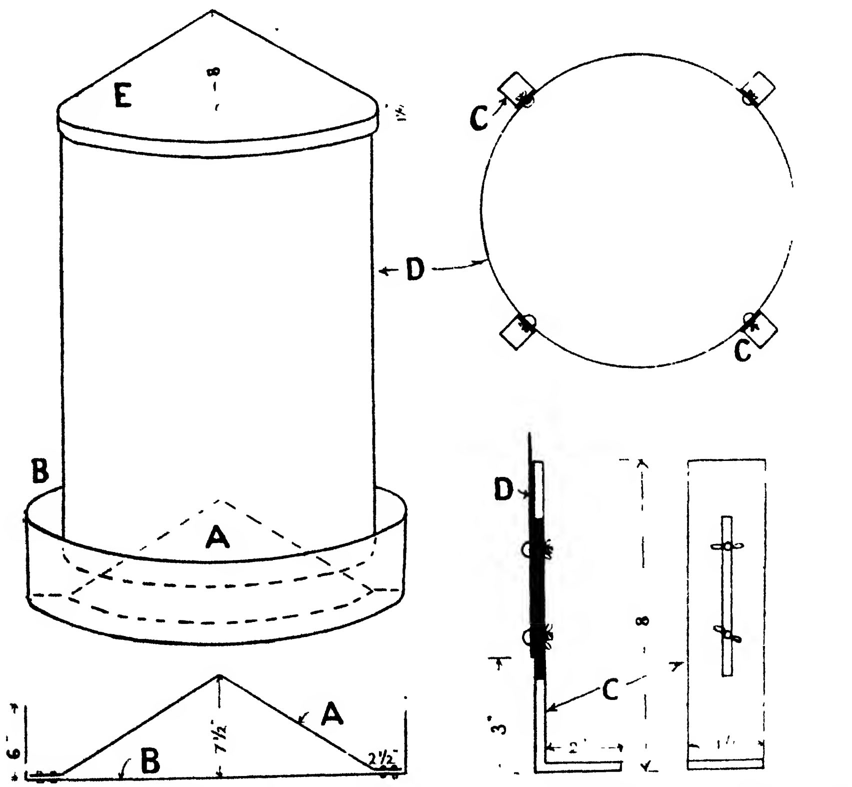


Fig. 20.—Dry feeder made from a 44 gallon drum (A) Cone distributor (B) Feeding tray rivetted to cone. (C) Iron legs bolted to drum. (D) 44 gallon drum. (E) Conical shaped lid.

drums vary considerably in diameter it is necessary to make new measurements for each drum. The sketches are practically self-explanatory but there are one or two points that should be mentioned. It is usual to rivet the distributing cone "A" to the bottom part of the tray "B" so that the legs "C" supporting the drum are resting on a double thickness of flat iron.

Four legs are used to support the drum at a height of about 3ins. above the bottom of the tray. The legs are attached to the drum by gutter bolts and wing nuts as shown in sketch, and can be adjusted to the required height.

Drinking Water for the birds should be provided in such a manner that contamination is impossible. The usual form of watering is a trough of some description in which the water is controlled by a ball tap. This method has proved successful provided the trough was covered to prevent contamination. Fig. 21 shows the type of trough that has been recommended by this Department and is included in the sketches of the semi-intensive laying shed. The trough is made of plain galvanised iron, is approximately 6ft. long, 4ins. deep and 6ins. wide at the top. The supply pipe and ball tap are at one end and a draining plug is inserted in the bottom of the other end. It is essential to cover the trough as a protection against the sun especially during the summer months.

A brass nipple watering system has been in use for some years in Queensland and has proved most successful. It would appear to be ideal for the prevention of water contamination, and is most economical in water consumption as it

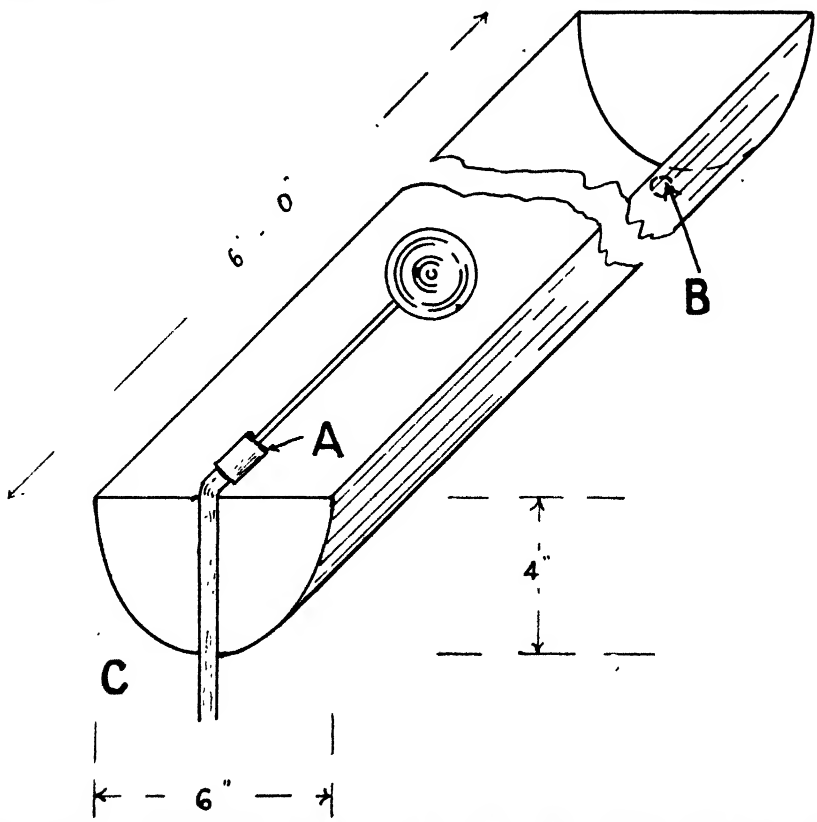


Fig. 21.—Common type of water trough. (A) Ball tap. (B) Draining plug. (C) Water supply pipe.

eliminates the waste which is inevitable with a trough system. Fig. 22 illustrates the type of nipple in use in Queensland; the casting "C" is approximately ¾in. in length, and is threaded for ¼in. at one end to screw into the water pipe. The valve stem "E" fits loosely in a hole bored through the centre of the casting and the valve seats at the threaded end. A bird drinking the small droplet of water "F" hanging to the end of the valve stem lifts the valve

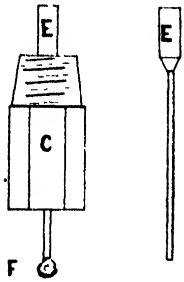


Fig. 22.—Brass nipple. (C) Octagonal casting ¾in. by ⅝in. threaded at one end. (E) Valve and stem. (F) Droplet of water.

sufficiently to release another drop of water. A ½in. pipe is drilled and tapped to take the nipples, which are spaced about 1ft. 6ins. apart. As this method of watering requires low pressure it is usual to break down the pressure by running the water into a cistern, controlled by a ball tap, before it reaches the nipples. The pipe carrying the nipples should be about 1ft. 6ins. above ground level.

When a piped water supply is not available, it is possible to use the nipple system by connecting the pipe carrying the nipples to a water container which would require filling periodically. Fig. 23 shows the suggested arrangement using a 44 gallon drum as the container.

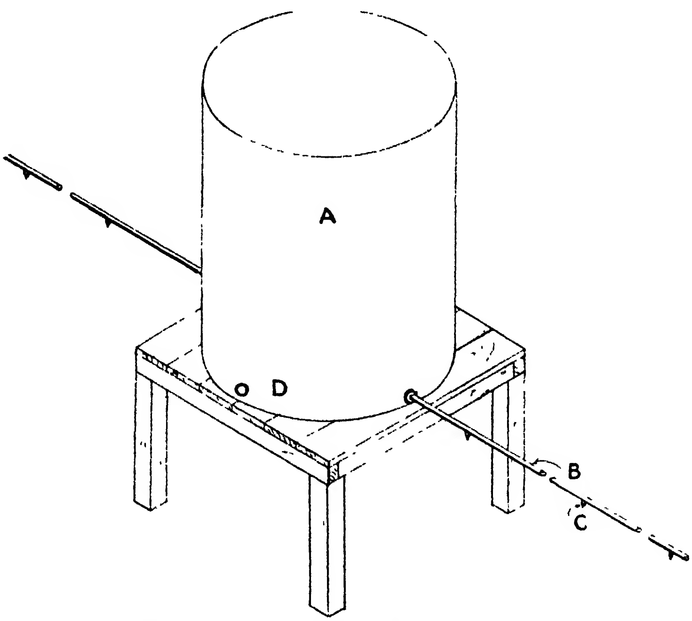


Fig. 23.—Nipple watering system. (A) A cistern or drum water container. (B) ½in. pipe 1in. above the bottom of the container. (C) Nipples. (D) Draining plug.

Finally, the object of this article is to improve the standard of the buildings on a poultry farm, so that, over a period of years, the poultry farmer will build up a valuable asset which will deteriorate slowly, and will give him a pride in his work, and make that work easier.

ACKNOWLEDGMENT.

Grateful acknowledgment is given to the Chief Draftsman, Lands and Surveys Department for completing the designs from drawings submitted by the authors.

FRUIT AND VEGETABLE SHIPMENTS TO SINGAPORE

A Report by H. R. POWELL, Superintendent of Horticulture.

(*Continued from Vol. XXV, No. 2, Page 185.*)

APPLES.

Two hundred bushels of Granny Smith apples were loaded at Fremantle for Singapore as non-refrigerated cargo on the M.V. "Charon" on the 5th November, 1947. They were stowed in two stacks of 100 cases each, one being on deck and the other in the upper tween cattle deck. Each stack consisted of similar fruit and the same range of sizes.

Although it was known that it was far too late in the season to export apples as non-refrigerated cargo, the superintendent of the State Committee of the Apple and Pear Marketing Board, Mr. R. M. Carter, shipped the fruit for experimental purposes associated with my visit. This practical co-operation was very much appreciated.

Weather conditions were observed during the voyage and data collected covering temperature and humidities under both tween deck and deck conditions. In addition pulp temperatures were recorded daily. A full report will be made on this aspect of the investigation.

It can be mentioned that pulp temperatures rose steadily. The highest temperature recorded was 95° in the top layer of apples in the case immediately under the tarpaulin covering the stack. Otherwise there was little difference between the temperatures of the fruit on deck and in the tween deck which ranged from 80°-85° towards the end of the voyage.

The first signs of "core flush" were noticed six days after leaving Fremantle and it developed steadily throughout the voyage. Slight signs of "scald" associated with sunburn injury were noticed on the second day and it also progressively developed during the voyage.

Unfortunately, owing to the wet weather experienced during the last two days, it was not possible to make a thorough inspection of the deck fruit prior

to berthing at Singapore as had been arranged with the ships' officers. However, early in the morning of 13th November when the vessel berthed at Singapore, a quick examination was made.

The chief defects noticed developing during the voyage were as follows:—

(a) Scald—associated chiefly with sunburn injury.

(b) Yellowing.

(c) Core Flush.

The "Charon" arrived in Singapore on the morning of the 13th November and through the co-operation of the Australian Trade Commissioner, Mr. J. Payne and Mr. R. E. Rew, representative of a West Australian fruit exporting firm, contacts were made with importers and dealers.

Mr. Rew's Chinese assistant, Douglas Chee Kim Khoon, was of very great assistance as a translater in the discussions with the Chinese dealers. Many of them do not speak English and much information would not have been obtained but for this help.

During the course of my stay in Singapore, which extended to the 5th December when I returned on the M.V. "Gorgon," I was able to see the discharge of 19,931 cases of Western Australian apples and approximately 3,000 cases of Victorian apples ex the "Orestes" which arrived on the 29th November. I was also able to see small consignments of Canadian and American apples.

Western Australian Apples.

M. V. "Charon"—It was mentioned earlier that the chief defects with the apples on the "Charon" were "scald," "yellowing" and "core flush."

Subsequent visits to the dealers' premises confirmed this and most of the fruit, originally green in colour, was found to be yellowed, particularly the $2\frac{3}{4}$'s (YYY). The $2\frac{1}{2}$'s were mostly two-thirds yellow GYY, and the $2\frac{1}{4}$'s were mostly half to two-thirds yellow, GY to GYY. Bruising was very prevalent and there is no doubt that this condition is very much disliked by dealers. Dealers stated that during recent months Granny Smiths had been arriving much too yellow in colour. "Core Flush" was also very much in evidence.

"Orestes"—Approximately 22,500 cases of apples in refrigerated stowage were discharged from the "Orestes" of which 19,931 were loaded at Fremantle and the balance at Melbourne. The Western Australian fruit was all Granny Smiths and the Victorian consisted of Granny Smiths, Dunns, Democrats and Yates.

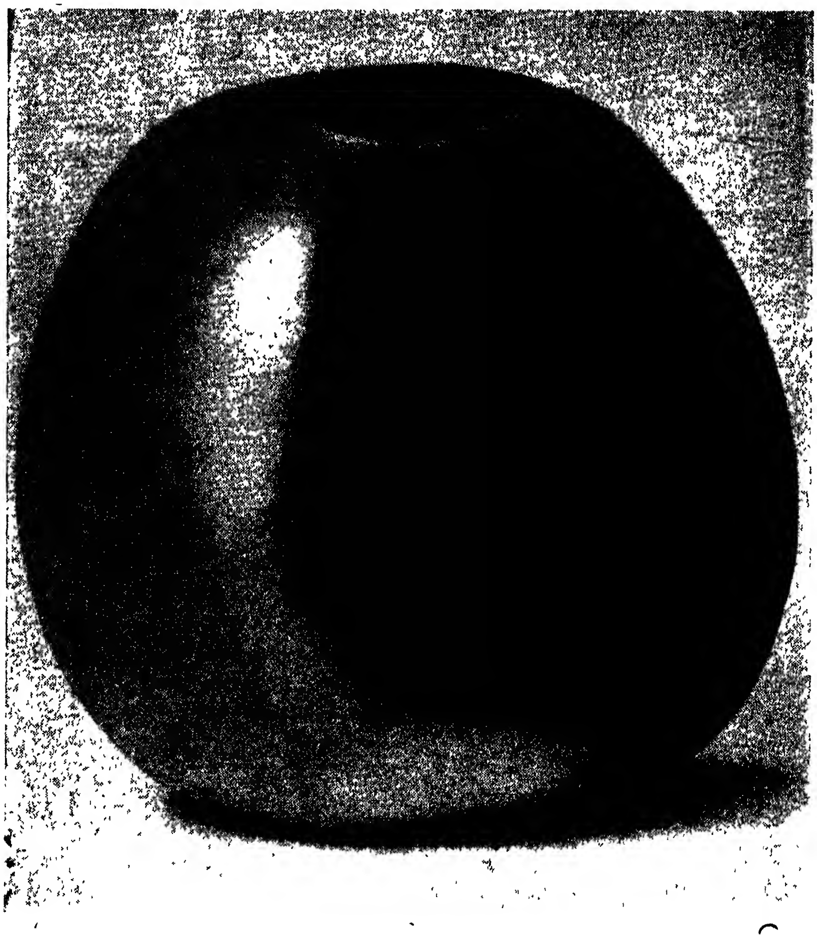
The vessel arrived on the morning of Saturday the 29th November and unloading commenced at 4.0 p.m. that day and continued over the next seven days. The long time taken to discharge the cargo was due mainly to hold-ups associated with extremely wet weather, but there was some delay caused by the reluctance on the part of some dealers in picking up their fruit.

Defects Noted.

(a) *Yellowing*—Chinese buyers prefer apples that are green and hard. They are particularly fond of Granny Smiths and the preference for the green colour applies not only to apples but to grapes as well. I endeavoured to ascertain the reason why this colour is preferred and the nearest approach I could get was that "green" is a symbol of "prime condition."

The "Charon" consignment, although it sold reasonably well, would not have been shipped so late in the season as deck cargo but for my visit. The original colour ex cool store was green but during the voyage of approximately 12 days the fruit rapidly yellowed. The larger sizes ex the M.V. "Orestes" maintained their colour fairly well, but it was evident that yellow colour was rapidly developing.

(b) *Scald*—Unfortunately, some time prior to my visit two cargoes carried by the "Asphalion" and "Gorgon" had arrived in a deteriorated condition owing to "scald." The fruit sent ex the "Charon" and "Orestes" was not



Granny Smith 2½in. apple seen at Singapore affected with "scald" in association with sunburn injury.

(Photo.: H. R. Powell.)

generally very badly affected although in some individual instances this disorder was very pronounced. It was almost invariably associated with sunburning, even slight sunburn injury. The dark colour rapidly developed and perhaps owing to climatic conditions, became almost an ebony black. Members of the

Fruit Importers Association at a meeting to which I was invited, were particularly critical of the amount of "scald" in the fruit carried by the "Gorgon" the previous September. The fruit in question came mainly from the Donnybrook district. Criticism was expressed that owing to the operation of the Apple and Pear Marketing Board, no selection of particular growers' supplies could be obtained, and the fruit lacked its pre-war uniform quality.

(c) *Pressure Marks*—A considerable quantity of Granny Smiths seen were badly affected with bruises and pressure marks. This fault is very unpopular with the Chinese and they stated emphatically that they would prefer the apples to be packed not so tightly and with no bulge. Unfortunately in Western Australia the harvesting season is normally associated with rain and the fruit becomes very susceptible to bruising during harvesting operations and to pressure marks when packed, unless very carefully handled.

(d) *Core Flush*—"Core bush" is a disorder of overmaturity and would not, I think, be normally seen in Singapore. As pointed out previously the late deck shipment made on the "Charon" rapidly deteriorated. The larger sizes were most affected but the 2¼'s in some instances, were equally as bad. An affected apple although appearing healthy outwardly, shows when cut, a dark discolouration of the tissue in the core region.

(e) *Red Flush*—During cool moist growing seasons, particularly in the Great Southern districts, a pronounced "red flush" is common on yellow and green varieties notably Dunns, Cleopatras and Granny Smiths.

In some seasons the "flush" becomes an intense red colour. With late stored fruit, however, the colour fades to a dirty brown. This condition was noticed on many occasions in Singapore and marred the appearance of the fruit.

(f) *Wrapping Paper*—In some instances white wrapping paper was used instead of the green paper normally used. This was very much disliked by the dealers and they stated emphatically that green paper should always be used. As mentioned earlier the colour itself has a definite connection in the minds of Chinese buyers with good keeping quality.

It was very apparent that the defects of the previous shipments, had made buyers extremely nervous. Although they were aware that the Granny Smiths on the "Orestes" would be a refrigerated cargo, great uneasiness was shown by dealers as they feared the quality of the fruit would be marred by "scald."

The lesson to be learned, is that one bad shipment can affect subsequent good shipments to a considerable degree, by destroying the confidence of buyers.

On one dealer's premises, with an audience of dissatisfied spectators, I was shown a number of cases of Western Australian 2¾ Granny Smith apples brought by the previous "Asphalion" that had been shipped non-refrigerated and subsequently cool stored, probably a week or so later after discharge. The condition of the fruit was very bad. Approximately 50 per cent. of the contents had broken down due to "rots" and the balance was yellowed and badly bruised. There was no doubt that the fruit had been cool-stored in an effort to salvage higher prices and was in no condition to be stored. It was impossible to appease them, but the opportunity was taken to explain that late shipments should be made in refrigerated stowage.

Subsequent Improvements.

(a) *Non-refrigerated Shipments*—It was stated that September and October shipments of large 2¾ Granny Smiths had arrived in a deteriorated condition —it was certainly true with regard to the "Charon" shipment in November. Most importers interviewed, said they would prefer this size to be shipped in refrigerated space after the end of July. This is understandable as the value of the variety on the Singapore market lies in its green colour and ability to retain this condition for some considerable time.

The smaller sizes particularly the 2¼'s, would probably hold their condition to the end of September and the 2½'s to the end of August but it would be wise if this market is to be safeguarded, to use refrigerated space for all sizes from the end of July onwards.

It must be emphasised, however, that since the war non-refrigerated shipments have been made late in the season only because adequate refrigerated space has not been available. Unfortunately when losses are made, buyers are slow to forget and tend to obtain their requirements from other sources.

(b) *Wrapping Paper*—Green oil wraps should be used wherever possible. It is realised that last year shortages of the green paper were responsible for the white paper being used. As mentioned previously good keeping qualities of the fruit is associated, in the minds of Chinese importers, with the green colour of the paper.

(c) *Packing*—In order to reduce the extent of bruising and other defects, it is suggested that particularly when Acquisition ceases and growers seek to specialise on export orders, as some did previously, it would perhaps be advisable to cool store apples for this trade loose in boxes after they have been sized and graded; the fruit to be packed when export orders are received. This would enable defective fruit to be culled out before packing. In addition there would be a tendency for the fruit to toughen up and become not so susceptible to pressure marks when packed. This is common practice in the Eastern States and it was noticable that the Victorian Granny Smiths ex the "Orestes" were firm and free from pressure marks and bruises.

Although packing should be firm it should not be tight and pronounced bulges should be avoided.

(d) *Scald*—Apples affected with sunburn should not be included in packs for this market, particularly from the end of June onwards. Scalding is very prevalent during certain seasons and is often associated with sunburn injuries. As mentioned previously, the prevalence of this disorder in one particular shipment caused a great deal of nervousness amongst buyers and affected adversely the sales of subsequent shipments.

(e) *Sizes*—2½" Granny Smiths are preferred. 2¾'s are not so popular because they yellow too quickly and show up bruise and pressure marks more so than do the smaller sizes. Small apples, 2¼'s, did not appear to be generally liked but they could be sent with advantage later in the season when refrigerated space is not available for the larger sizes.

(f) *Cleopatras*—There is a limited market in Singapore for Cleopatras but dealers insisted that they should be hard and green in colour on arrival. A suitable shipping date would be the end of February.

(g) *Labels*—Very few of the consignments ex the "Orestes" were labelled and this omission caused considerable criticism. Dealers considered that all quality fruit should be labelled and this has been customary with other exporting countries. They were of the opinion that when labels were not used, it was on account of the exporter considering the consignment in question was not good enough to label. The Chinese are susceptible to appearances and good presentation including labelling, is essential on this market.

American grape and apple boxes seen were all labeled. Many of them bore striking designs that could not fail to instil confidence in the minds of buyers.

The actual use of colours is important for instance black and white are not popular with the Chinese as they are mourning colours; red and yellow are favoured in this order, but as yellow is the royal colour it should not be over-done; green is the most popular colour.

When labels are used the greatest care must be exercised in ensuring that they are properly attached to the cases. There were a few instances of consignments of oranges from the Eastern States which arrived in an unsightly condition owing to the labels becoming loose or badly torn. The labels on the American grape cases were so firmly attached that it was difficult to secure even one or two as specimens to bring back.

(h) *Cases*—All the Western Australian fruit seen was packed in redwood dump cases doubly wired and they arrived in good order. The quality of the cases was fairly good but they were certainly not up to pre-war standards. These cases are popular in Singapore and they are handled very carefully on account of their resale value. There was no suggestion that the standard apple box should be used.

(i) *Stencilling*—Although mostly very good there were instances of indistinct stencilling. The uniform system adopted gave the whole consignment the impression it had been handled through one packing centre. No matter how good the stencilling is done, however, it will always be a poor substitute for labels.

(j) *Branding*—In some instances the shipping brands were carelessly applied and misleading. Some confusion was caused by two consignments, prepared apparently by the same agent. The shipping brands were TH and T.H.S. A faint S alongside the former brand, indicating that the same stencil had been used, caused the two consignments to become mixed and resulted in a lot of unnecessary trouble to the two importers concerned.

Normally the fruit is collected from the ship's slings by coolies employed by the importer, and it is thus very necessary for the shipping brands to be clear and distinct.

Victorian Apples.

Approximately 3,000 cases were discharged from the M.V. "Orestes" as refrigerated cargo. The varieties were Granny Smiths, Yates Dunns and Democrats.

Seen during discharge the fruit seemed to be in good condition and it was noticed that a system of grading to 1/8ths had been adopted.

A quantity of Granny Smiths and Yates were seen subsequently on dealers' premises and some Granny Smiths, 3in. size, were a total loss due to "scald" and "breakdown." The balance of the fruit in one case which was 50 per cent.

broken down, was completely marred by severe scalding Another case from the same grower showed 100 per cent. "scald" and 30 per cent. "breakdown;" other cases showed some breakdown but little. "scald." The sound fruit was in a very good condition and of excellent quality. It is interesting to point out that even the large sizes were free from bruises and pressure marks. The pulp temperature of the fruit two days after discharge ranged between 70° and 73°.

A number of cases of Yates was seen; the fruit was sound but colour was weak and the line was generally unattractive. An endeavour was made to trace the Dunns without success; it was learnt later that they had been quickly disposed of as Army contract. Some Democrats were seen on a stand in the Orchard Road Market. The quality was excellent and there were only a few broken down fruits in the cases seen. There does not appear to be much demand for red and yellow varieties. The red ones are considered to be too dry.

American and Canadian Apples.

Quantities of American and Canadian apples were seen on one dealer's premises. They were packed in standard boxes made of pine.

(a) *Canadian*—Newtown Pippins—138 Extra "Fancy" from the Keremeos Packing House, Keremeos, British Columbia.

Deep blue crepe lining paper was used, giving a pleasing contrast with the clean white of the boxes. The wrapping paper was printed to the effect that doctors and dentists recommend apples for health and that the fruit should keep in a cool moist atmosphere.

The fruit was green, evenly sized and of good quality. Shipment was made to Hong Kong as refrigerated cargo and as deck cargo from Hong Kong. I understand that the journey from Hong Kong is of approximately six days' duration. It was stated the cost of the fruit was $22 (£3 4s. 0d.) c.i.f.

(b) *American*—White Winter Pearmain—150 "Fancy."

Brand—Dewsweet.

The labels were particularly attractive and were printed on very good quality paper. The fruit was mostly dead green and hard which is wanted on this market. The boxes were stamped by the inspection service to the effect that fruit was of approved quality.

Newtown Pippins—"Fancy" Grade.

Brands—Green Thumb and N.M.B.

The 2¼'s were green but woody in texture and heavily russeted around the stem ends; there was no cracking. The 2¾'s were yellowing and were also badly russeted. Apart from this, however, the fruit was free from blemishes, perfectly sized and attractive looking. The boxes used were standards with tops consisting of four narrow pieces of wood with large spaces between them and were lined with blue paper. These apples were selling in the vicinity of $20 (£2 18s. 0d.) a box, the landed cost being $18 (£2 12s. 0d.).

It was stated that the American shipping season for White Winter Pearmain extends from August to September and for Newtowns, September to November. Normally the American fruit would have the market from August onwards.

Wholesale Prices.

The approximate landed cost of Granny Smiths during this time was as follows:—

	£	s.	d.	
F.o.b.	1	7	6	
Freight (refrigerated) and Insurance ..		8	2	
	1	15	8	($12.20)

	£	s.	d.	
F.o.b.	1	7	6	
Freight (non-refrigerated) and Insurance		6	7	
	1	14	1	($11.70)

(Two and eleven pence is taken as the equivalent of the Malayan dollar.)

Landing charges would be in the region of 30 cents (10½d.) a case, thus sales had to be made in the region of $12 to $12.50 (£1 15s. 0d. to £1 16s. 6d. a case) to cover normal handling expenses. There is no doubt that huge profits were made by dealers in 1946. I was told the peak price that year was $45 (£6 11s. 0d.) a case. According to the same dealer the highest price obtained in 1947 was $24 (£3 10s. 0d.).

Wholesale prices for the inferior fruit ex the "Charon" ranged from $4 (12s.) to $16 (£2 7s. 0d.) a case. Receipts practically cleared all expenses incurred with the shipment.

The discharge of the apples ex the "Orestes" was somewhat protracted. Those who got early deliveries were fortunate in that they got their fruit on the market ahead of competitors and received premium prices from $1 (2s 11d.) to $2 (5s. 10d.) a case. Opening prices were $16 (£2 6s. 8d.) for 2½'s and $13 (£1 18s. 0d.) to $15 (£2 3s. 9d.) for 2¾'s and 2¼'s. The market later settled down from $13 (£1 18s. 0d.) to $14 (£2 0s. 10d.) a case.

It was obvious that dealers were apprehensive with regard to the development of "scald" and there was little tendency to cold store excess requirements in the hope of obtaining higher prices later on.

Wholesale prices for Eastern State apples ranged from $9 (£1 6s. 3d.) to $13 (£1 18s. 0d.) for Granny Smiths, $9 (£1 6s. 3d.) to $10 (£1 9s. 2d.) for Yates and Democrats.

Some dealers complained that the c.i.f. cost was too high. It should be $10 (£1 9s. 2d.) they said, and this price would enable them to make sales ranging from $11.50 (£1 13s. 6d.) to $12 (£1 15s. 0d.) a case. Many of the dealers were despondent at this time, as most imported fruit with the exception of apples was being sold under cost.

Retail Prices.

The retail prices bore little relation to the wholesale prices. A check was made at three representative centres, namely the retail shop of the Singapore Cold Storage in Orchard Road, the Orchard Road Market, mainly patronised by Europeans and wealthier Chinese, and the Native Market in Beach Road.

There are very few retail shops as we know them, the bulk of the fruit being sold through markets, road-side stalls and by hawkers. The quantity of fruit of all types displayed for sale is tremendous.

	Singapore Cold Storage.	Orchard Road	Beach Road
Granny Smiths—W.A.	15c.-20c. ea. (5½d.-7d.)	15c.-20c. ea. (5½d.-7d.)	15c.-20c. ea. (5½d.-7d)
Democrats—Victorian	—	20c. ea. (7d.)	—
Newtowns—U.S.A.	30c. ea. (10½d.)	30c. ea. (10½d.)	30c. ea. (10½d.)

The retail prices show perhaps the market preferences for hard green apples. The American Newtowns compared more than favourably with the late stored Australian apples.

The retailer makes a large profit and appears to prefer restricted sales at high prices to a quick turnover at more moderate prices. The retail price of 5½d.-7d. an apple is equivalent to from £3/4/2 to £4/1/8 for a case of large 2½'s (140's). Comparable wholesale prices probably ranged from £1/18/- to £2/-/10d. a case. The climate is oppressive and is not conducive to the fruit retaining its condition for long, particularly late cold stored apples and some losses due to wastage are unavoidable.

Deteriorated fruit finds a ready sale with hawkers who salvage the sound portions. It was a common sight to see pieces of apples carefully peeled and trimmed being offered for sale to those who could not afford to buy a whole apple.

General.

The main faults encountered with Western Australian Granny Smiths were "yellowing," "scald," and pressure marks. To a large extent these can be obviated by more careful attention by growers when packing. Fruit affected with sunburn injuries should not be cool stored for the Singapore export trade. As far as "yellowing" is concerned, non-refrigerated shipments should not be made after the end of July as far as the larger sizes are concerned; the smaller sizes could perhaps be sent to the end of August as far as the 2½'s are concerned and to the end of September for 2¼'s.

A recent report received covering a non-refrigerated shipment made during July 1948 revealed that the 2¾'s were yellowed and affected wholesale prices by approximately $2. (5/10) a case. It is realised that shippers have had very little say in the past few years and have had to avail themselves of what shipping space is offering.

South Africa has made a determined bid for the citrus market and is meeting with considerable success. As this country is also a large apple growing country, it is possible that strong competition will be met in the future with apples as well.

THE ARGENTINE ANT.

(*Iridomyrmex humilis.* Mayr.)

By C. F. H. JENKINS, Government Entomologist.

INTRODUCTION.

THE native home of the Argentine ant, as its name implies, is believed to be the Argentine Republic. It is recorded, however, from other South American countries, and has been introduced into the United States of America, where it is reported to be still spreading. It is now established in many countries of the world and on the island of Madeira is said to have been so successful as to have supplanted completely all the native ants on the island. It was known in South Africa as long ago as 1908, and it still remains a serious pest in that country.

The first record of the ant in Australia came from Victoria in September, 1939. It was not long however, before the pest was located in Western Australia, the original specimens being sent to the Department of Agriculture for identification by residents of Albany in April, 1941.

Regulations were immediately gazetted quarantining the affected area, but unfortunately later inspections made in metropolitan districts showed that the ant had gained a firmer hold than was first suspected. It has now been necessary to prevent the sending, from within a five-mile radius of the Perth Town Hall to other parts of the State, plants in pots or packed in soil except with a permit from the Department of Agriculture.

GENERAL DESCRIPTION.

Being social creatures, Argentine ant colonies contain queens, males, and workers. It is the workers which are most commonly seen, and whose presence cause the actual trouble. In size they resemble very closely a number of other

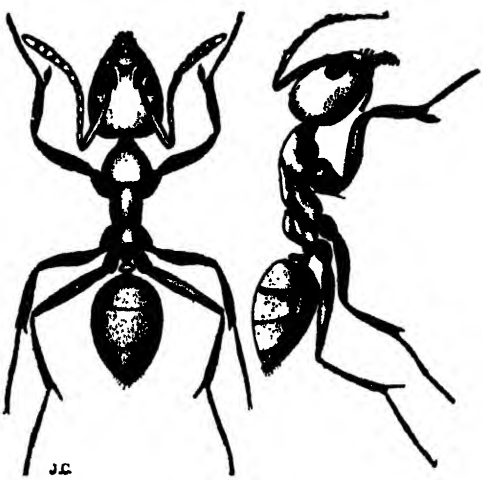


Fig. I.—Argentine Ant Workers.
(After Clark.)

common house ants measuring about ⅛ of an inch in length. They are a uniform honey brown in colour, and do not give off the formic acid smell so characteristic of most ants when crushed. This is not an infallible means of identification, however, as other local ants are also characterised by this lack of odour.

Fig. 11.—Small colony of Argentine Ants.

(From U.S. Dept. Agric.)

The winged male ants are seldom seen, but are somewhat larger than the workers. The virgin queens are winged and are also larger than the workers. When saddled with the responsibility of maintaining the population numbers of a colony they grow still more due to the increase in the size of the egg-distended abdomen and shed their wings.

LIFE HISTORY AND HABITS.

The size of ant colonies may vary considerably, containing from dozens to thousands of individuals, and the number of queens present may vary from one to a hundred.

The full details of the life history have not been worked out locally, but in America the ant has been exhaustively studied. It has been found that after the appearance of winged males and females in the nest a nuptial flight may or may not follow. In either case the females, after becoming fertile, lose their wings and commence egg laying. They may lay 30 or more eggs a day, and live for several years. Most of the eggs develop into worker ants, but at certain seasons males and queens also appear. Like most ants the individuals of this species are great foragers. Strong trails of the insects will travel considerable distances in search of food, invade houses, or swarm over trees and other objects where suitable attractions are to be found. So strong is their colonising ability that other ant species often find it difficult or impossible to survive where the Argentine ant is well established.

MEANS OF DISPERSAL.

The fact that nuptial flights are not the regular habit of this ant, and that in some countries the females have not been seen to fly at all means that the natural dispersal of the pest is very slow. It is mainly by artificial means that the insects have been spread about the world, and here again is an important point to note. In order for the species to establish itself a whole colony containing at least one fertile queen must be transported. It is not enough to carry large numbers of workers to a fresh district. These may survive for a long time, but they would not be able to reproduce.

It will now be clear why strict quarantine regulations are passed preventing the removal of plants in pots, and soil from infested areas, for by such means a whole colony may easily be carried. It is a common habit of the ant to establish itself in seed boxes or pot plants or even debris and leaves associated with plants. It is by no means only in plants, however, that the insects can be spread, for colonies may make their way into old packing cases, manure heaps and similar refuges, but infested nursery stocks and stable manure have proved to be the most dangerous means of dispersal in this State.

PRESENT DISTRIBUTION IN WESTERN AUSTRALIA.

Although various reports have been received from time to time concerning the presence of the ant in widely separated country areas, there is no evidence to suggest that the pest is widespread in this State. It is firmly established at Albany and in Perth, and isolated outbreaks have been recorded at Wanneroo, Kalamunda, and Bunbury. Investigation has shown all other reports to be groundless.

Fig III.—Orange tree after exposure to Argentine Ants for three seasons.
(From U.S. Dept. Agric.)

TYPE OF DAMAGE CAUSED.

Besides being a domestic menace the ant is a serious orchard pest and it is as such that it is mainly feared.

As an Orchard Pest.

Injury is not actually caused by the ant itself but the creatures are greatly attracted by the honey-dew given off by scale insects, aphides, and mealy bugs, and so heavily infest trees carrying these pests. The swarms of ants running hither and thither over the twigs and branches prevent ladybirds, parasitic wasps, and other useful insects from exerting their normal control, and furthermore the actual attention from the ants causes more honey-dew than usual to be excreted. Consequently fruit and foliage are soon covered with the dirty sooty mould fungus associated with insect honey-dew, and the scale or aphis population rapidly rises with consequent detrimental effects upon the trees.

Fortunately, the main orchard districts in Western Australia are still free of the ant but in California and South Africa the control of such pests as mealy bugs and red scale is largely dependent upon whether the Argentine ant can first be subjugated.

As a Household Pest.

The Argentine ant is practically omnivorous in its taste attacking sweets such as sugar or honey and cooked meat or bones with almost equal readiness. Its persistence is unequalled by any other species, and at times houses have even been vacated on account of the persecution of this insect.

CONTROL MEASURES.

In the words of two Californian workers (Eckert & Mallis 1941), "The Argentine ant can be reduced or exterminated only through continuous and unrelenting efforts that match the ants in persistence." All attempts to combat the pest must be co-operative and sustained. Especially does this apply to suburban and city infestations, where the efforts of some householders may be largely nullified by the apathy or carelessness of neighbours.

Factors Influencing Control

The first essential in controlling ants as a household pest is to see that no crumbs or particles of food are left about to attract the insects. Despite all efforts however, more direct action is often necessary and circumstances must determine just what methods may be used most effectively. The need for general cleanliness out of doors is also very important as bones and food scraps in the yard are very attractive to the ants. Old litter such as grass and leaves is a favourite harbourage especially in the wintertime and should be periodically burned or treated for ant control. Clean cultivation in shrubberies and orchards also greatly facilitates ant control. In clean cultivated orchards there is little ant movement between trees, but in overgrown weedy plots it is often difficult to find a space which has not been colonized.

Weather and Seasonal Conditions.

Temperature greatly influences ant activity, for extremes of heat and cold are unfavourable to the creatures. Under Californian conditions baiting has proved most effective in the spring and autumn when temperatures are moderate

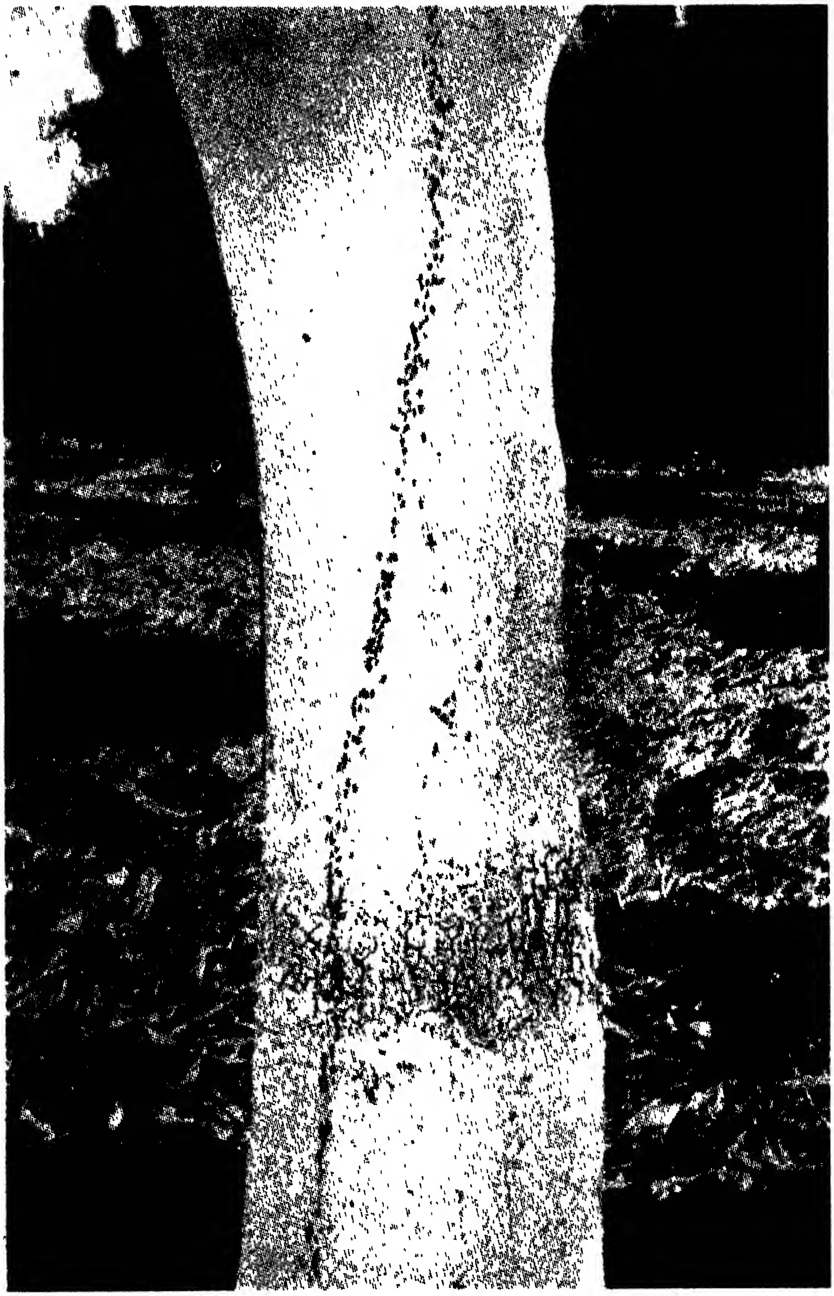


Fig. IV.—Characteristic trails of the Argentine Ant in a tree trunk.
(From U.S. Dept. Agric.)

and natural food such as honey-dew less plentiful. There is evidence to suggest similar influences in this State and in addition the rate of reproduction is so rapid in mid-summer that in spite of a heavy death roll the numbers often appear unaffected.

Fumigation.

When it is possible to find the ants' nests by tracing along the trail of workers, the entire colony may be destroyed by pouring into the hole a couple of tablespoonsful of carbon bisulphide. Where several holes are present all should be treated and the openings blocked with moist earth to prevent the escape of the heavy gas generated. (Carbon bisulphide is explosive and inflammable, and so should be used with care.)

A liberal sprinkling of calcium cyanide dust into the hole if the entrance is subsequently blocked will also be found effective.

Poison Dusts.

Many types of powders have been used against ants with varying degrees of success. D.D.T. mixtures varying from 2 per cent. to 10 per cent. have been used with good effect, the stronger concentrations giving the best results. Other powders used are sodium fluoride, Paris green, arsenical sheep dip and sodium fluosilicate. The powders should be sprinkled about in places frequented by the ants and liberally sprinkled into and around the nest entrances. The efficiency of powders depends upon their being finely ground and dry, for the tiny particles cling to the legs and body of the workers and are eaten in subsequent cleaning and grooming operations as well as being fed to the queen and other occupants of the nest. Ant eradication by this means is a long process but it is only by patience and persistent treatment that the pest usually is overcome.

Baiting Technique.

The control of ants by the use of poison baits is seldom immediate and an obvious reduction in numbers may not be apparent for days or even weeks. Furthermore, no dead ants will be seen around the tins (excepting those accidentally drowned) as the poison is slow acting and allows the workers to return to their nests, where some of the poison will be fed to other ants including the queens. It is the destruction of the queens that is essential for the eradication of a colony, hence the spasmodic spraying of worker trails or the use of boiling water while alleviating the immediate position has little effect upon the general situation.

Unfortunately, ants are very sensitive indeed to poisons and many baits are taken for a short time and then entirely ignored. On this account it is quite impossible to prescribe a universal ant bait. If ants do not visit the tins, the location of the containers should be changed, but if ants visit the tins in gradually decreasing numbers then control is being effected.

Bait tins or waxed paper cups (such as ice-cream buckets) with lids and of about 3½ oz. capacity should be used. The containers should be distributed every few feet particularly near the foundations of the house where ant trails are found. No trail should go unbaited and a concentrated drive carefully planned will give much better and more lasting results than desultory baiting every time the ant nuisance makes some action imperative.

Often the ants will make a shallow nest under the actual bait container; if this occurs the tin should be moved and the nest treated preferably with D.D.T. but otherwise with kerosene, boiling water or other contact insecticides.

Bait tins should be kept clean and fresh, as crystallised syrup is not attractive to the ants. Containers should also be free from foreign material or odours before being filled, otherwise they may repel ants coming to the bait. On this account tins should be freshened up and, if necessary, cleaned about once a week.

The accompanying illustration shows the suggested distribution of bait tins on a suburban allotment.

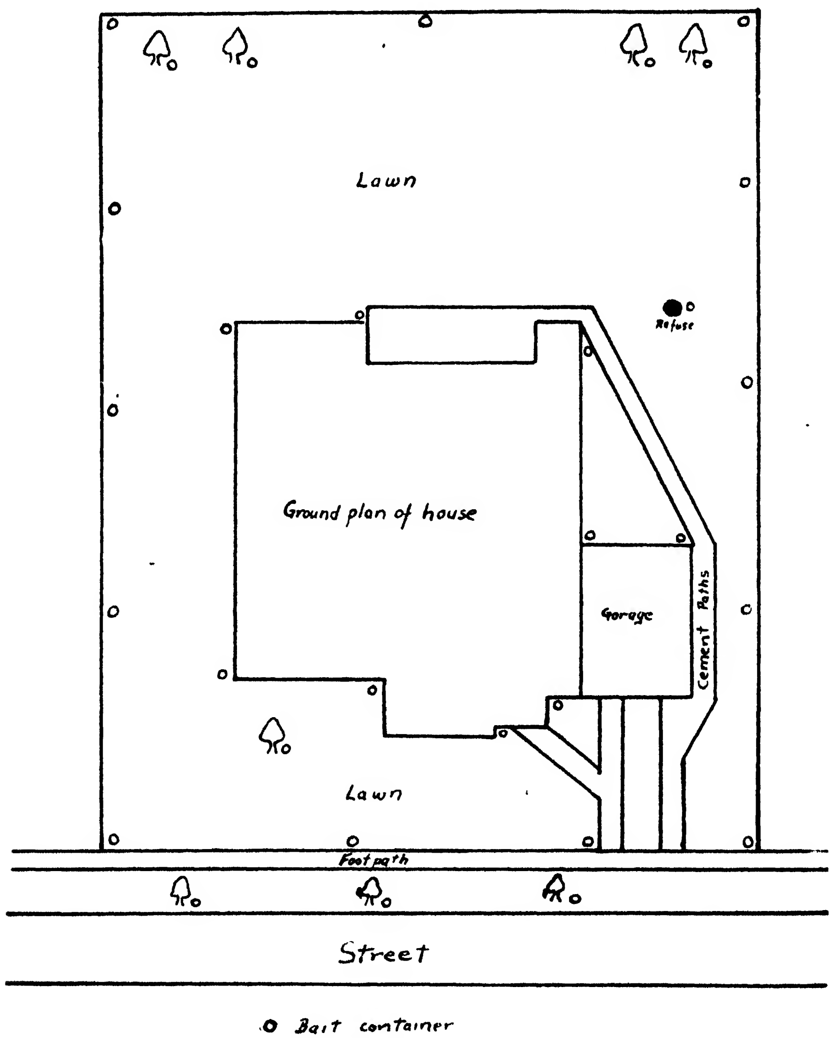


Fig. V.—Diagram of residential block showing distribution of bait containers.

Argentine Ant Baits.

A formula, known as the U.S. Government Formula, which has been satisfactorily used, against the Argentine ant in many countries as well as locally is prepared as follows:—Sugar, 1 lb., tartaric acid, crystallised, 10.3 grains; benzoate of soda, 14.6 grains; sodium arsenite (chemically pure), 26 grains; water, 5/6th pint; honey, 2¼ oz.

The water should be warmed in a clean vessel over a low fire. When it is tepid, the tartaric acid, benzoate of soda, and the sugar (slowly) should be added. The mixture must be stirred constantly to prevent burning. The depth of the liquid in the vessel should be measured with a stick. Then bring the mixture slowly to the boil and allow to simmer for 30 to 40 minutes. Remove from the stove and add water to the original depth on the measuring stick to make up for evaporation. The honey should then be stirred in before the mixture cools and the sodium arsenite, which has been dissolved in 1.8 fluid oz. of hot water and partially cooled, poured into the syrup.

The foregoing preparation is on the local market as a proprietary line, and is sold under the name of "Anti Ant" (liquid).

By substituting an equal amount of aromatic honey for the sugar in the previous formula, the time required for boiling may be reduced and the tartaric acid omitted. The resulting formula, known as "The Californian Argentine Ant Syrup," is as follows:—

Honey (any aromatic kind)	18⅓ ozs.
Benzoate of soda	14.6 grains
Water	1 pint
Sodium arsenite	26 grains

The mixtures need be boiled only for a few minutes to ensure a uniform mixture and to kill yeast and mould spores.

Other Formulae.

(1) 1½ lb. sugar or honey.
2 pints water.
31 grains arsenite of soda (equal to a moderately heaped penny).

Dissolve the sugar in warm water, then add arsenite of soda, stirring well.

(2) For meat and fat-eating ants the following bait may be tried:—
Fat, 1½ breakfast cups.
Arsenite of soda, 5 grains (moderately heaped threepenny bit).

Warm the fat and stir in the poison. Bacon rind with a little poison rubbed into the fat may also be tried. (The danger to animals and children of such baits should be remembered.)

(3) Paris green—1 oz.
Brown sugar—1 lb.

Mix thoroughly and place small quantities under boards or stones where ants occur. Sprinkled through infested lawns, it has also been found effective.

Bait Containers.

Syrup baits are best used in closed containers in such a way that the ants can enter but so that the contents are protected from dogs, children, etc. The

bait tins should be half filled with syrup and a small piece of sponge, wood wool or other absorbent material may be placed inside to serve as a foothold for feeding ants.

Types of containers which have been used successfully.

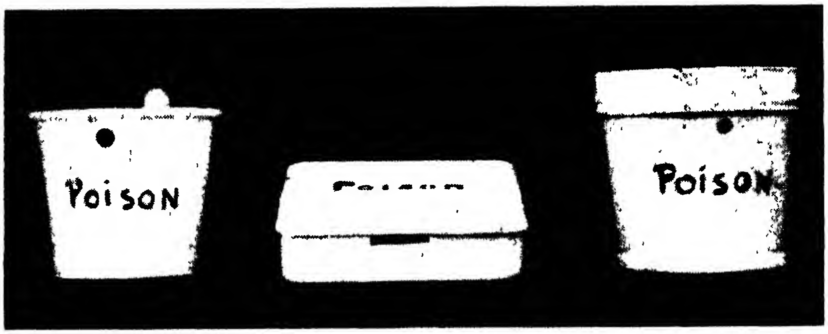


Fig. VI.—Bait containers—ice-cream bucket, tobacco tin, and screw top wax carton

D.D.T. Spraying.

The use of D.D.T. dusts has already been referred to but the most rapid and spectacular results in Argentine ant control have been obtained with D.D.T. sprays. There are various types on the market, some being oil or kerosene solutions, and others in forms suitable for dilution with water. For general purposes the latter are recommended as they are cheaper than oil solutions to use and less likely to cause injury to plant foliage. There is also some evidence to suggest that the residues left by water mixtures, on certain types of surfaces at least, are more effective than those from oil solutions even though comparable concentrations of D.D.T. are contained in both mixtures.

D.D.T. spraying cannot be regarded as a cheap method of Argentine ant control, but a carefully applied spray treatment may so reduce the numbers that results will far exceed those obtained by spasmodic outbursts of activity followed by long intervals of neglect. Such methods are in the long run both expensive and ineffective.

Spraying Equipment.—For satisfactory treatment out of doors, something more than a hand atomizer is required. Stirrup pumps such as those used in A.R.P. exercises during the last war are quite satisfactory, and are useful for general garden spraying. Knapsack sprays are also satisfactory, but more elaborate and expensive than the stirrup or bucket pump.

The quantity of spray required will, of course, vary with the size of the allotment and the degree of infestation. In the case of a badly infested quarter acre block, the treatment of fences, shrubs, building foundations and paths may require 20 gallons or more of 2 per cent. D.D.T. mixture for the initial treatment. A single treatment of this nature will be much more effective than a series of half-hearted attacks and in the long run will prove to be the most economical.

For Household Control—Outdoor Treatments.—Where a premises is badly infested a general spray treatment is recommended.

The foundations of all buildings up to a height of about 12 inches should be sprayed. The edges of concrete paths and garden borders should be treated as well as the fence line and any other areas where nests are present and where the ants are particularly active. Fruit trees and shrubs should be trimmed so as not to drag on the ground, and the butts and main branches should be sprayed. If any limbs touch the fence or the house these may provide a bridge by which ants can cross treated areas. Backyard vines are particularly troublesome in this direction. The garbage tin and its surroundings should also receive special attention.

The efficiency of D.D.T. sprays depends not upon the immediate knock-down from the spray, but upon the fact that the residue remains toxic to ants walking over treated surfaces days and weeks later. The period of effectiveness of a single treatment depends upon the concentration of D.D.T. used, the type of surface treated and the extent to which weathering or other agencies may be involved.

For outdoor use a 2 per cent. water mixture is recommended, although weaker strengths will give some degree of control. Special attention should be given to windows, doors, ventilators, water pipes and other obvious channels by which ants may normally enter a house.

Once the population has been reduced by a general spray treatment, it should be possible by "spot" spraying and continued baiting to keep the pest well under control. Spraying alone has been shown to finally eradicate a colony for, of course, if every worker leaving the nest is killed by the surrounding spray residue, the other occupants of the nest must either die of starvation or emerge themselves only to meet a similar fate to the earlier foragers.

Indoor Treatments.- It is sometimes reported that following general outdoor spraying eruptions indoors may be more frequent for a short time.

Where it is necessary to deal with ants that have actually gained a foothold indoors, immediate relief can usually be obtained by spraying with any of the proprietary kerosene fly sprays. General spraying indoors with water mixtures of D.D.T. is not always possible as unsightly stains may result. Window ledges, skirting boards, ventilators and similar areas may be painted or sprayed, however, with 3 or 4 per cent. kerosene solutions of D.D.T. Bait tins also can be placed at strategic corners to give ants established under the house a ready supply of food, and so reduce their tendency to forage through every room in the building.

Trap Nests.

The habit of Argentine ants sheltering and nesting (especially during the winter) in accumulation of litter, garden rubbish, etc., has already been referred to. This habit is sometimes exploited by deliberately placing suitable shelters such as small heaps of straw, large flat stones etc., in favoured localities in the hope that ants will nest in or under them after which they can be suitably dealt with either by burning or spraying. Such ant traps may have their uses if carefully watched, but there is always the danger that they will be neglected and so prove a further menace rather than a relief.

Fig. VII.—Spraying main trunks of lemon trees with D D T for control of Argentine Ants.

Orchard Control.

As stated earlier in this article, the Argentine ant can cause considerable damage to fruit trees owing to its habit of tending "ant cows" such as mealy bugs, scale insects and aphids.

Affected trees should be trimmed free of the ground and the butts and main branches should be sprayed with a 2 per cent. D.D.T. water mixture. The treatment must be carefully done and branches must not have contact with the ground through wooden props or similar supports. In one test conducted in a badly infested orchard the apparent failure of one treatment was traced to a wooden prop by means of which the insects had climbed to the upper branches and moved from tree to tree through the interlacing upper leaf canopy.

Actual tests with a 1 per cent. D.D.T. emulsion kept trees ant free for seven weeks and after fourteen weeks only a very light infestation was in evidence.

The necessity for clean cultivation has been stressed previously and particularly is this important around the outer rows of the orchard. Re-infestation will often occur from thick grasslands surrounding the orchard, and special care should be taken to police outer rows once the orchard has been freed of the pest.

Above ground water pipes often serve as pathways for the ants and should be sprayed and kept under strict observation, in addition to spraying if any ant activity is noted on the ground.

The Possibilities of Control and Eradication.

There have been many who have expressed a doubt as to whether Argentine ant control much less eradication is possible. The answer to this viewpoint is contained in the following quotation dealing with Argentine ant control campaigns in the United States of America (Smith 1936).

"Control campaigns were therefore inaugurated through a co-operative arrangement between the State Plant Board and the infested communities, with the assistance of Mr. Barber in directing the work. The first of these campaigns were conducted in four towns—Durant, Laurel, Crystal Springs, and Woodville—during the fall of 1920, and they were so successful that others were undertaken in the following years. Since 1920 the plant board has supervised this work, while the municipalities and counties have paid the expenses. This work reached its height in 1929, when 121 localities were poisoned for the ants, 1,136,028 *cups of poison* being used at a cost of approximately $35,000. Even in the depression years there has been a steady demand for control work, although the towns and counties have been handicapped by lack of funds.

The early campaigns were designated control campaigns, and the word 'eradication' was not used. In 1924, however, an area embracing a block and a half at Fayette, Miss., was freed of the ants after two successive fall campaigns, at an exceedingly low cost (15). So far as is known, this was the first town, not only in Mississippi but in the world, from which the ants had been eradicated. Later other towns began to eradicate the ants, and by 1928 six—Fayette, Shaw, Lyman, Landon, Moss Point, and State College—had been freed of them (4). Since then State authorities have not only stressed the fact that it is possible to eradicate Argentine ants by timely and thorough campaigns repeated for several consecutive years, but they have encouraged the municipalities and counties to fight the ants in this manner."

These results were obtained by the poison baiting method already outlined and without the use of D.D.T. The latter insecticide enables much quicker results to be obtained and has greatly improved the chances of combating the Argentine ant, providing co-operative action can be stimulated and all treatments are applied with strict attention to detail.

WARNING.

Arsenicals.

Arsenite of soda and Paris green are highly toxic to man and domestic animals and great care should be used to see that all vessels are thoroughly cleaned after use, should any of the formulae be made up at home. Bottles of ant bait should be clearly labelled poison, and care should be taken in the distribution and filling of the bait containers.

D.D.T.

At the concentrations recommended D.D.T. is not highly toxic to man or animals; care should be taken however, not to contaminate foodstuffs and contact with liquids, especially oil solutions, *should be avoided* as much as possible.

SUMMARY.

1. All attempts to combat the pest must be co-operative and sustained.
2. Place tobacco tins or other suitable containers half filled with bait wherever the ants are active (for preference outside the house).
3. Cut or punch holes in sides of tin and close lid for safety and to prevent evaporation.
4. Keep tins clean and add fresh bait at least once a week.
5. Change position of tins from time to time if ants appear to lose interest.
6. Do not relax baiting when there is an appreciable drop in ant activity.
7. Use 4 per cent. D.D.T. powder or 4 per cent. D.D.T. spray on window sills, cracks etc., where ants persist in invading premises.
8. Destroy rubbish such as old grass and leaves as this forms an attractive breeding place for the ants.
9. Spray the foundations of the house, the edges of concrete paths, the butts of infested fruit trees and shrubs, and any other areas where the ants swarm, with a 2 per cent. water mixture of D.D.T.

LITERATURE.

Annand, P. N. *et. al.* **1944:** "Tests conducted by Bureau of Entomology and Plant Quarantine to appraise the usefulness of D.D.T. as an insecticide," Journ. Econ. Ent., Vol. 37, p. 145.

Back, E. A., 1937: "House Ants," U.S.D.A. Leaflet 147.

Clark, J., 1941: "Notes on the Argentine ant and other exotic ants introduced into Australia," Mem. Nat. Mus. Vict. No. 12. p. 59.

Eckert, J. E. & Mallis, A., 1941: "Ants and their control in California," Univ. Cal. Agric. Exp. Stat. Circ. 342.

Jenkins, C. F. H. & Forte, P.N., 1946: "1945-1946 Experiments with D.D.T. and 666 as Agricultural Insecticides," Journ. Dept. Agric. W. Aust. (2nd Ser.), Vol. XXIII, p. 311.

Newell, W. & Barber, T. C., 1913: "The Argentine Ant," U.S.D.A. Bull. 122.

Pescott, R. T. M., 1939: "The Argentine Ant," Journ. Dept. Agric. Vict. Vol 37.

Potgieter, J. T., 1937: "The Argentine Ant," Farming in S. Africa, April, 1937.

Smith, M. R., 1936: "Distribution of the Argentine Ant in the United States, and suggestions for its Control or Eradication," U.S.D.A. Circ. 387.

Woglum, R. S., 1921: "Control of the Argentine Ant in California Citrus Orchards," U S.D.A. Bull. 965.

Woodworth. C. W.: "The Control of the Argentine Ant," Univ. Cal. Agric. Exp. Stat. Bull. 207.

A CRUSH FOR THE TUBERCULIN TESTING OF CATTLE.

A. RIPPER, Stock Inspector.

A STRONGLY constructed crush and serviceable holding yards are a necessity on all properties where numbers of cattle are required to be handled.

On properties where Tuberculin Testing is compulsory and it is necessary to deal with dry stock, bulls and young animals that have not previously been handled the provision of these facilities is absolutely essential.

The crush shown on the accompanying diagrams is specially designed for Tuberculin Tes ing but will serve equally well for vaccinations, branding or dehorning.

The essential features of this crush are:—

(1) An end bail (E on the diagrams) in which the beast is held while the test is being applied.

(2) An exit gate (D) through which the animal passes out after release from the bail.

(3) A block gate (B) which swings inwards completely blocking the race against the oncoming cattle and allowing sufficient space for the operator to enter the crush at the rear of the beast in order to make an injection of Tuberculin into one of the skin folds at the base of the tail.

The distance from the bail to the block gate when closed across the race should not be less than eight feet which will provide sufficient length to accommodate the largest beast and at the same time leave sufficient space at the rear of the animal to enable the operator to carry out the test.

Provided it is strongly constructed this structure need not be elaborate. No details of timber sizes, hinges, catches or bail design have been included since it is expected that the majority of farmers will have their own ideas and preferences and will make use of material already available on the property. Where sawn timber is not available bush timber will serve the purpose, but whatever material is employed it should not be stinted if a strong and serviceable crush is to be provided.

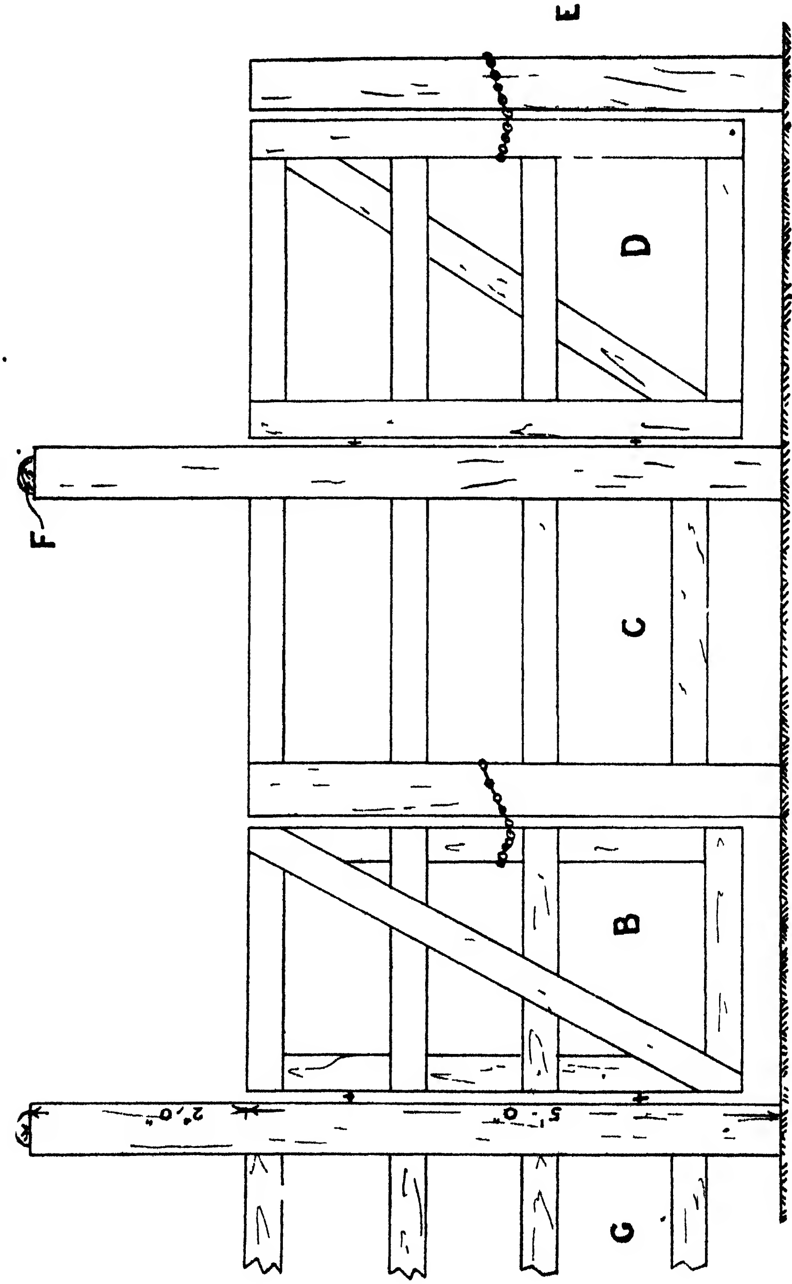
The width of the race is important and should not exceed two feet three inches. This will allow large dairy cows to pass through and will prevent small stock from turning in the race when they are not tightly crushed.

These additional notes will help to explain the diagrams:—

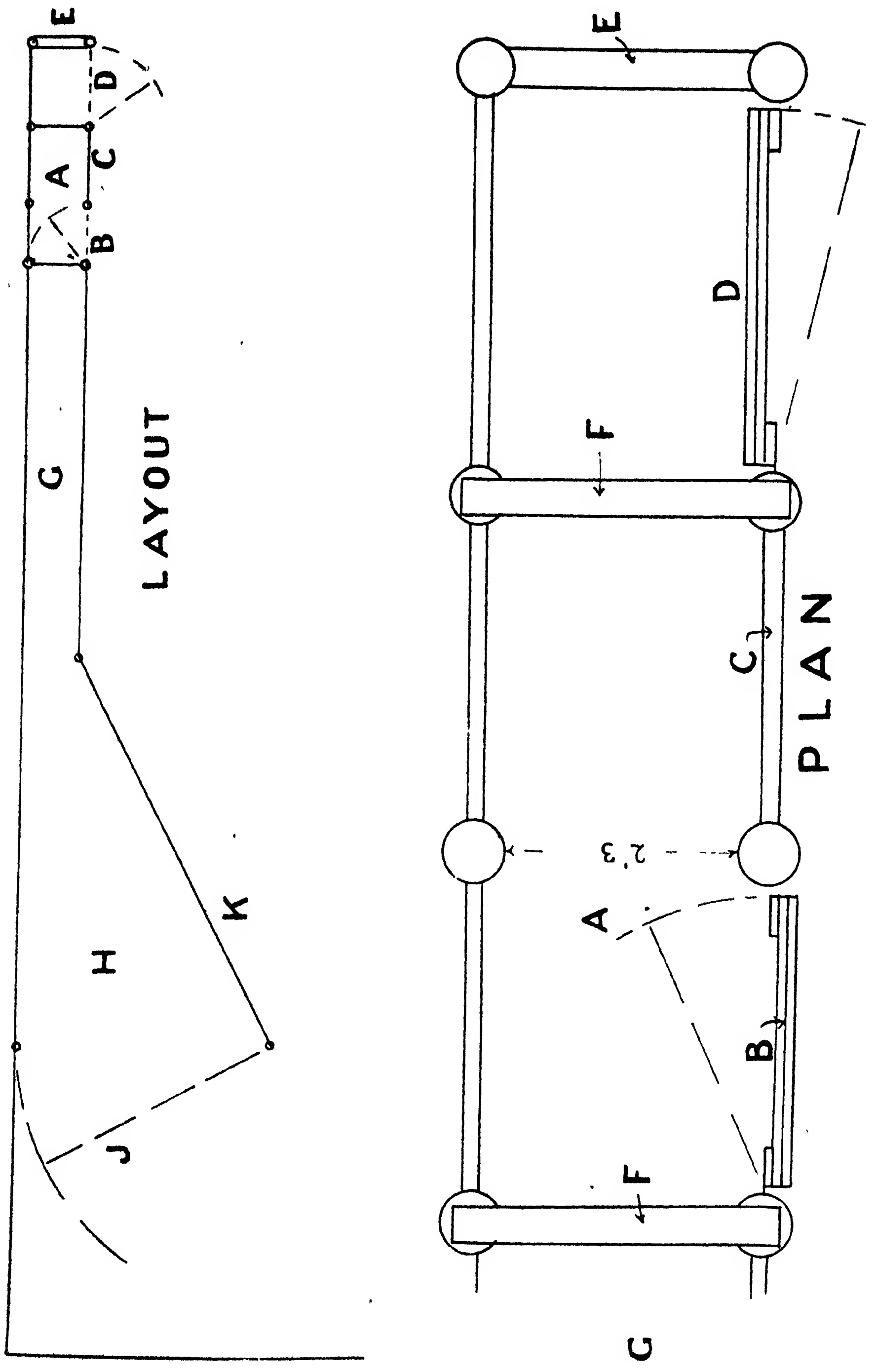
(A) Plan of the crush.

(B) A block gate, three feet wide, opening inwards to block the race (G) to following cattle and to allow access to the rear of the beast.

(C) A panel designed to give added length between the bail (E) and the block gate (B). The length of the panel will vary with the size of the gate used at (D)—together they should give approximately eight feet standing room.



Elevation


LAYOUT
E
D
C
A
B
G
H
K
J
PLAN
E
D
F
C
2' 3
A
B
F
G

(D) A side gate three to five feet wide to allow stock out after treatment.

(E) The end bail constructed to owner's own design but preferably self locking and readily adjustable.

(F) Ties across the gate posts to prevent the gates from sagging or the race spreading under pressure from the stock.

(G) The race. This should be five feet high with nine inches between rails. The length will vary with individual requirements but 20 feet will be found suitable for the average dairy herd. Do not make the inside width greater than two feet three inches.

(H) A force pen for filling the race. This is closed by a large gate (J) from the holding yard (K).

NOTICE.

SPECIMENS FOR ANALYSIS OR DIAGNOSIS.

Kind.	Address to.	Remarks.
Animals ...	Animal Health and Nutritional Laboratories, Smyth Road, Hollywood	
Birds ...	do. do. do.	
Blood ...	do. do. do.	Communicate with laboratory before collecting and despatch where possible.
Insects ...	Government Entomologist, Department of Agriculture	
Milk ...	... ...	Write to Department of Agriculture and ask for sample bottles, at the same time state for what purpose you want the test made.
Plants ... (Diseased)	Government Plant Pathologist, Department of Agriculture	Give full symptoms, details of fertiliser treatment, situation, etc., in accompanying letter. Supply whole plants showing different stages of the disease where possible. Send fresh but not wet specimens without soil. Wrap in paper not airtight tins.
Plants ... (for identification)	Government Botanist, Department of Agriculture	Specimens should show leaf arrangement, flower and fruit whenever possible. Press and dry between sheets of newspaper before sending. Letter should give details of habit, *e.g.*, tree, shrub, climber as well as locality and conditions under which plant grew.
Water (for Analysis)	Government Analyst, Adelaide Terrace, Perth	For *bona fide* farmers a fee of 5s. per sample. A clean bottleful the size of a beer bottle. State where sample is from, *i.e.*, well, dam, etc. In your letter, give description of container being sent and the date sent.

Important.—Wrap securely and clearly address all samples, place sender's name and address on the outside of parcel. Always write advising specimen on its way and if more than one being sent on different days mark them with the date. Parcels should be sent to arrive early in the week, not the week-end, so as to be in as fresh a condition as possible.

THE BANANA AS A HOST FRUIT OF THE MEDITERRANEAN FRUIT FLY

By C. F. H. JENKINS, Government Entomologist.

THE banana has never been considered a satisfactory host fruit of the Mediterranean Fruit Fly (*Ceratitis capitata*) and consequently the unusual activity of this fly in Carnarvon plantations last year may prove a matter of considerable importance to the industry. The general view regarding the Mediterranean Fruit Fly and banana infestation is stated by Back and Pemberton (1916a) as follows:—

"While it has been proved that bananas may serve as host fruits of this Fruit Fly when ripe, all data happily corroborate the general belief among shippers and growers as well as among entomologists familiar with the situation, that Chinese bananas and Jamaica or Bluefield bananas (*Musa* spp.) when cut and shipped under commercial conditions, are immune to attack and offer no danger as carriers of this pest if properly inspected and certified as provided for by the regulations of the Federal Horticultural Board."

Kirk and French both reported the occurrence of Mediterranean Fruit Fly in bananas but in critically reviewing the Australian literature Back and Pemberton (1916b and 1918a) consider these records to be very doubtful and recent correspondence from Mr. H. Smith of Queensland and Mr. T. McCarthy of N.S.W. entirely substantiate the views of Back and Pemberton.

Experience in Western Australia has been in accordance with the above views until the present records from Carnarvon and what will be the ultimate importance of these records it is still too early to say. The activity of the Fly was first brought to my notice by the Tropical Adviser for the Carnarvon District (Mr. G. Barnett) who stated that plantains allowed to remain on the breakwind plants were being heavily struck by Fly. Consignments of plantains and bananas (Cavendish) were then obtained for laboratory examination and both maggots and adult flies were obtained.

About ten dozen fruits were examined (having been specially selected in the field as showing Fruit Fly stings) and in a large percentage active maggots developed. In a number of cases the maggots failed to produce flies owing to the appearance of mould on the bananas and their premature breakdown. Numerous adults were reared however, from fruits which remained in a suitable condition. Mr. Barnett reported that the fly activity in the district may have been aggravated by the presence of neglected plantations and by the failure of growers to strip plantains used as breakwinds. The important facts are, however, that the majority of the bananas examined in the laboratory were picked green and in accordance with normal commercial practice and that from these fruits without any artificial assistance, adult fruit flies were reared. In addition to the consignments obtained direct from Carnarvon, one infested fruit was obtained from the Metropolitan markets where it had been offered for sale with a normal commercial line.

The activity of the Mediterranean Fruit Fly in the Carnarvon district will be watched in the future with great interest. Although known from Western Australia since 1895 it was not until 1934 that the insect was reported from Carnarvon. Since then citrus, figs and other well recognised host fruits have been frequently attacked.

There are a large number of hosts credited to the Mediterranean Fruit Fly. Quayle (1938) lists 137 including such plants as tomatoes and cucumbers which although commonly grown in this State have never been found infested. There is no explanation for the fact that a tomato is liable to Fruit Fly attack in Hawaii and is immune in Western Australia (Smith 1940, Back and Pemberton 1918b). There is some evidence to show that the insect may gradually develop a liking for certain fruits and although still not a popular host it is believed that grapes in Western Australia are more liable to attack now than in the earlier years of the industry. To suggest that a preference for bananas is being developed by the Carnarvon flies would at this stage be merely conjecture. This record however illustrates the danger of forecasting the potentialities of any pest or of placing too much reliance upon results obtained in other countries under environmental conditions differing from one's own.

The whole history of the Mediterranean Fruit Fly in Australia supports this contention. It was expected that this pest would prove a serious pest throughout the fruit growing areas of Australia. In Western Australia it has made steady progress. In Queensland it has never been bred from locally grown fruit (Smith 1939) and in N.S.W. where it was once troublesome it is now scarce and has been supplanted by the Queensland Fruit Fly.

Banana showing punctures made by ovipositing Fruit Flies.

REFERENCES.

Back, E. A. & Pemberton, C. E., 1916a: "The Banana as a Host of the Mediterranean Fruit Fly," Journ. Agric. Res. Vol V., p. 793.

Back, E. A. & Pemberton, C. E., 1916b: *ibid.* p. 801.

Back, E. A. & Pemberton, C. E., 1918a: "The Mediterranean Fruit Fly in Hawaii," U.S. Dept. Agric Bull. No. 536, p. 40.

Back, E. A. & Pemberton, C. E., 1918b: *ibid.* p. 38.

Quayle, H. J., 1938: "Insects of Citrus and other Sub-tropical Fruits," Comstock Pub. Co., N.Y.

Severin, H. H. P. & Hartung, W. J., 1912: "Will the Mediterranean Fruit Fly (*Ceratitis capitata* Wied.) breed in bananas under Artificial and Field Conditions," Journ. Econ. Ent. Vol. 5, p. 443.

Smith, J. H., 1939: "Insects and their Influence on Agricultural Development," Journ. Aust. Inst. Agric. Sci., Vol. 5, p. 148.

Smith, J. H., 1940: "Corrigendum," *ibid.* Vol. 6, p. 59.

CLASSING FARMERS' CLIPS FOR AUCTION.

W. L. McGARRY, Sheep and Wool Adviser.

THE correct classification of farmers' comparatively small clips is a task which will prove definitely profitable and can also prove very interesting. At times various factors militate against the best possible "get up" of the wool by farmers themselves, and these would include labour shortages and lack of adequate facilities. These factors, and at times a lack of confidence in their ability to class the clip, induces growers at times to consign their unclassed clips to brokers for reclassing before sale.

Very little, if any, technical wool knowledge is required to class the average farmers' clip to the best financial advantage. Classing of such clips to the best matching of similar fleeces into as few and as big lines as possible, out of which must be kept the odd irregular or "outsort" fleeces which do not match the main lines. The main qualifications required in the correct matching of fleeces are common-sense and good eyesight allied to adequate shed facilities, and an interest in the job being undertaken.

In the main it is more profitable, provided a reasonable job is done, to class all clips on the farm "hot" off the sheep's back. The double handling and double pressing that is involved with the reclassed clip can be detrimental to its appearance or "bloom" when it is opened up with a consequent effect on the value. This applies particularly where the sheep have been run on country that is loose in nature and where dust is prevalent. In addition to this, the cost per sheep for classing is much cheaper when done in the shed (even with a paid classer) than in the reclass store. It is obvious that where the farmers do their own classing a direct saving of the total reclass charge is made.

Apart from these considerations, an intimate knowledge of the covering the sheep are producing is very necessary in any policy of flock improvement, and this knowledge can only be fully acquired at the classing table.

Shearing Shed Facilities.

The returns from wool sales represent a large proportion of farmers' incomes today, and in view of the importance of wool in this respect, it is essential that every consideration be given to factors affecting its preparation for market.

These include:—

Adequately designed sheds that will allow of sufficient space for shearing, wool bins, wool tables, press and plenty of light.

If good work is to be done at shearing time, these things are indispensable and it is disconcerting to record that comparatively few sheds in the farming areas possess adequate facilities that are indispensable to good classing.

Wool Sheds.

On the majority of farms, these serve the manifold purposes of shearing, storage, machine sheds, etc., and it will be found that, in most cases, some rearrangement of the shearing board, bins, wool tables, etc., will minimise faulty work, confusion and delay at shearing time, and enable the best use to be made of the available space and light.

There are many plans and designs of shearing sheds available to choose from and in the erection of shearing sheds the following points are well worth remembering.

1. Shed space must be laid out economically to ensure the most efficient handling of sheep and wool, and in planning the wool room it is necessary to aim at a quick, clean, handling of the fleece with the wool travelling in the one direction towards the press.

2. It is a definite advantage to build the shed off the ground. Advantages with these types of sheds are:—

   (i) The space underneath can be used to house woolly sheep overnight and in the event of rain.

   (ii) If the shed floor and adjoining ramp are built to the level of the floor of a motor truck, the labour involved in handling, storing, and loading super, seed wheat, wool etc., is considerably reduced. Heavy laborious lifting is avoided in this manner, and this applies particularly to periods during labour shortage and where large areas are to be topdressed or seeded quickly.

   (iii) A shed built off the ground allows easy cleaning from under the sheep pens.

Catching Pens.

Penning up can be made much easier if the side of the catching pen facing the shearing board is close boarded or covered to a height of about six feet. In this way the movement of the shearers and others working adjacent to the sheep on the board is obscured, and as a result, the sheep will run much easier when being penned.

Lighting.

The question of light is particularly important in view of the fact that the bulk of shearing is done when the days are short and often cloudy.

A good light is essential if the clip is to be classed to the best financial advantage, and in addition a good light enables the classing to be carried out quicker and easier. Very few shearing sheds in farming areas are sufficiently lighted to class wool properly, and the question of light seems to be one that is overlooked or ignored by many farmers when constructing their sheds or when arranging their sheds in preparation for shearing. Farmers are not doing justice to their clip or their pocket in preparing their wool for market in a poor light and then subjecting it to the acid test of display and valuation under the excellent lighting of a wool showfloor.

Bad light also hampers the handling of the sheep in the shed and is certainly not conducive to good shearing. Sheep will move into lighted pens quicker, and with less trouble than if the pens are in semi-darkness, which is applicable to many sheds. When sheep are driven out of strong sunlight into a dark shed, trouble is experienced in getting them housed, and this is largely overcome when a shed is well illuminated with natural light.

Factors conducive towards improved lighting in shearing sheds are:—

1. Installation of saw-tooth type of roofs.
2. Installation of skylights.
3. White washing of the inside walls and roofs of sheds. This will improve the lighting considerably at a small cost.
4. Temporary removal of a few sheets of iron from the roof during shearing—avoid sun glare.
5. Rearrangement of pens, wool bins, wool tables and shearing board, so that the available light can be used to the best advantage.
6. Replacing the galvanised iron or board sides of wool bins with wire netting or battens.

Wool Tables.

An adequate wool rolling table is indispensable if the preparation of the fleece for classing is to be done efficiently and expeditiously. The work involved on the wool rolling table is most important, because it is at this stage that the initial, and probably most serious faults occur in the "get-up" of the clip. Half the classing is done if the skirting, backing and rolling is correctly and quickly carried out, and the provision of an adequate wool rolling table is absolutely essential if efficiency and speed in fleece preparation are to be achieved.

Good work is possible only on a table of satisfactory dimensions, and wool rolling tables should be of sufficient length and width to accommodate a fleece that lays flat without it overhanging the sides or the ends of the table.

The minimum length and width of a wool rolling table should be 10 ft. x 5 ft. with batten space ¾ in. to 1 in. apart. It is definitely preferable to have a table a little on the large side than to have one on the small side. The big majority of tables in use today are too small for good work and these could be enlarged to an adequate size at little cost with extensions in the form of flooring boards, or additional battens fixed to the sides and/or ends of tables.

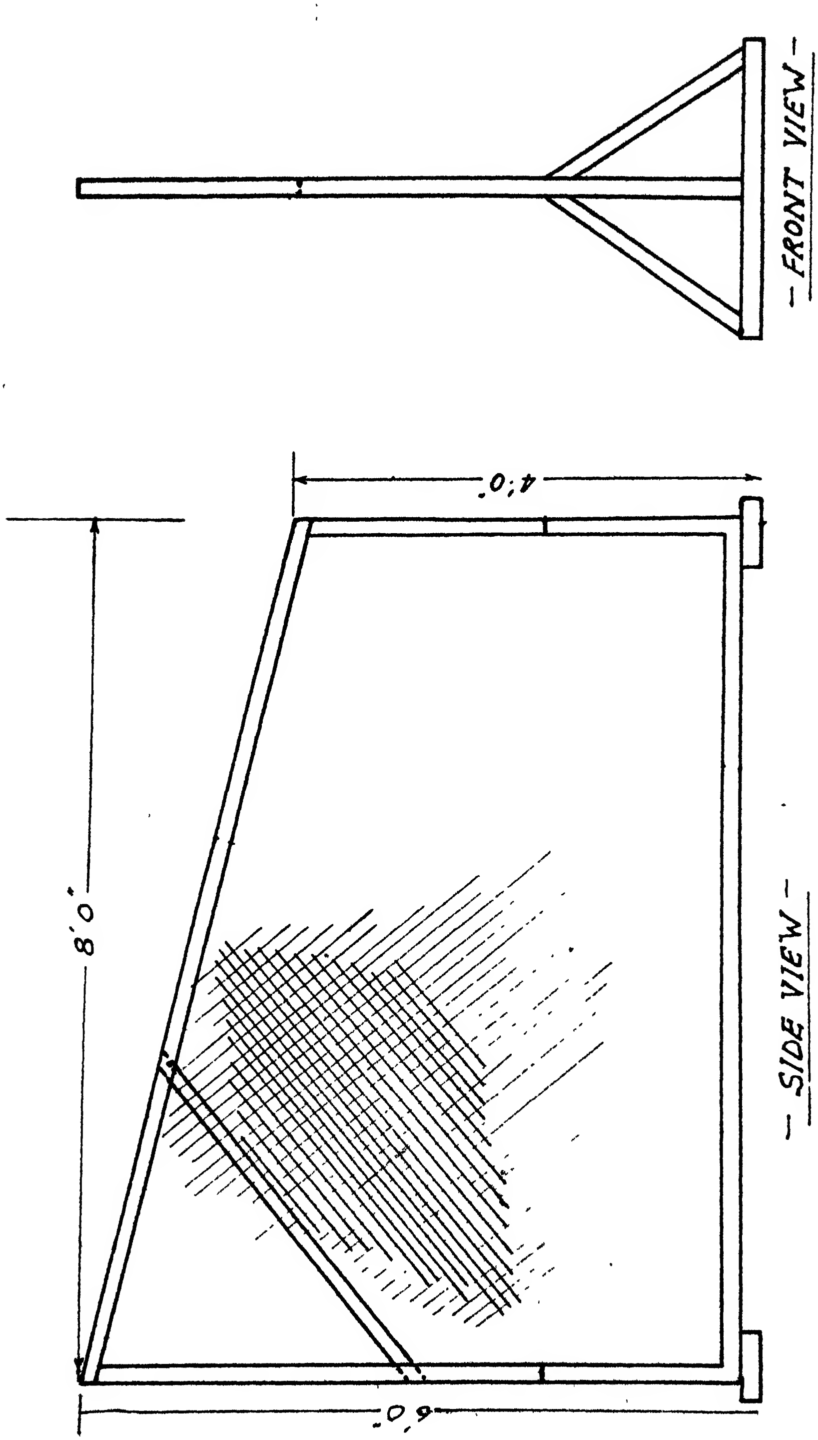
Folding legs or trestles are a definite advantage over fixed legs on a wool table, in that the table can be stored in the shed in a minimum of space when not in use.

Wool rolling tables should not be too low or too high as this is not conducive towards good work. Wool tables that are too high and too low can also prove very fatiguing to work on at length. Efficient skirting is impossible if the table is placed against a wall. It is necessary to arrange the table so that the skirter can move around it freely.

Floor boards or hessian placed around the legs of the table temporarily will keep floor pieces and dags out and save the time involved in shaking these out of the table locks.

Wool Bins.

It is necessary to have at least six bins in the average farmer's flock of 1,000 to 1,500 sheep. In larger flocks more bins are necessary and in the rush of shearing more bins mean better classing, more convenience, less work and less double handling. One disadvantage of fixed bins is that they limit the space for storage after shearing. Another drawback is that these bins are generally made the same



PORTABLE WOOL BIN.

size, with the result that there is insufficient room for the main lines and too much for the other lines. Fixed bins are usually close boarded or made with galvanised iron sides, and as a result are generally lacking good illumination. Plenty of light should penetrate each bin to enable the classer to see that the various lines are kept uniform and to allow of comparison of neighbouring lines of wool. It is an advantage to avoid placing wool bins against a wall if possible. If they are arranged so that the presser can obtain the wool from the back of the bin, this will give the presser, classer and other shed workers full freedom of movement without delaying or interfering with their work.

Portable Wool Bins.

The portable or movable type of wool bin is recommended and its advantages are:—

1. After shearing these can be moved into the sheep pens and this allows the use of the maximum storage space for super, grain, etc.
2. Convenience in small sheds. Portable bins are easily adaptable to suit any size of bin necessary to accommodate the amount of wool required for various lots.
3. Better light penetration to each bin.
4. Can be moved or placed anywhere in the wool room during shearing.

Portable bins can be made of light timber (8 ft. long and 6 ft. high) in the form of frames, with the uprights fitting into "feet."

Uprights—2 in. x 2 in. x 6 ft.
Cross pieces—2 in. x 1½ in. x 8 ft.
Foot pieces—3 in. x 2 in. x 18 in.

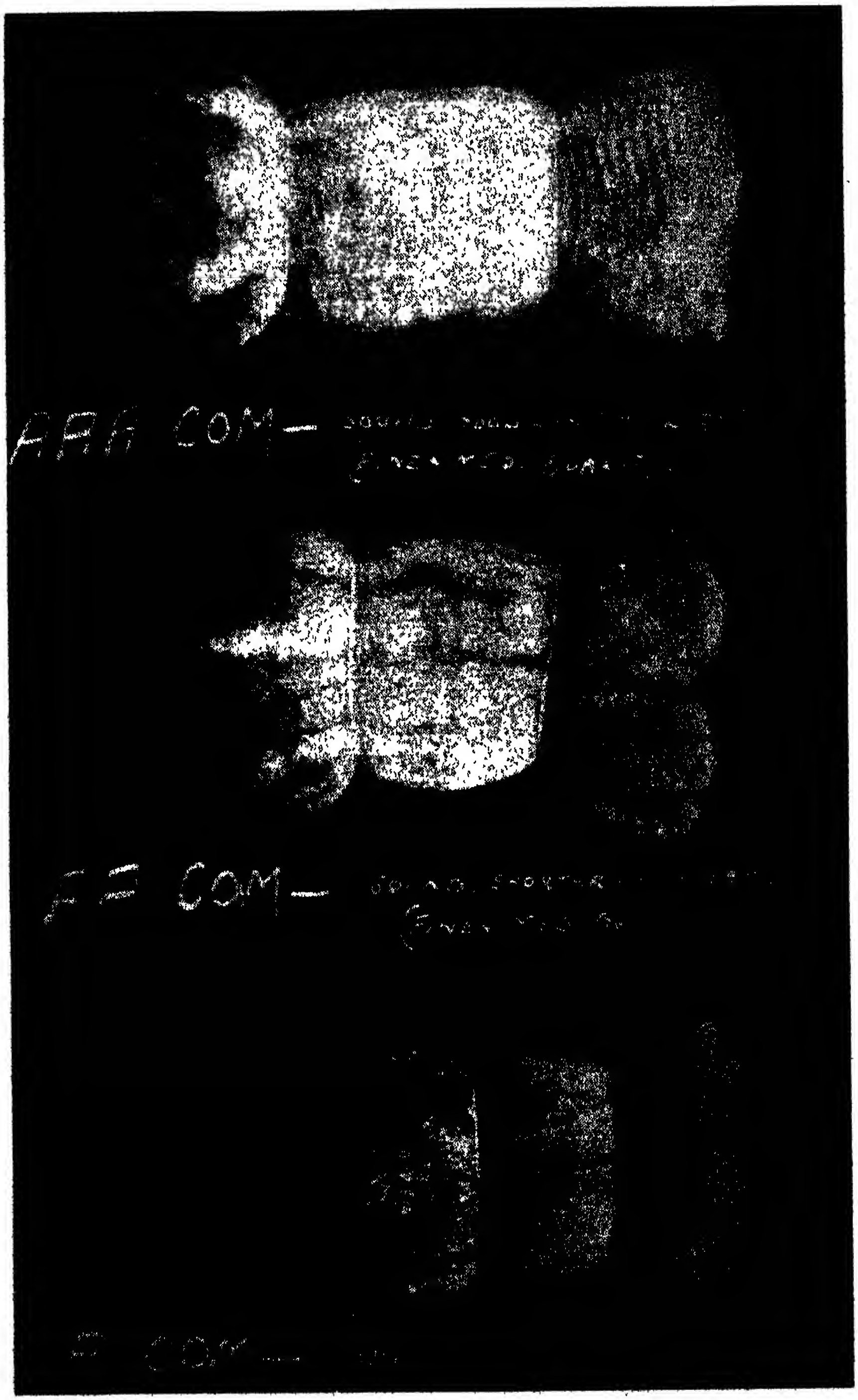
It is necessary to cover the frames with wire netting and this should be stretched tightly across the frame.

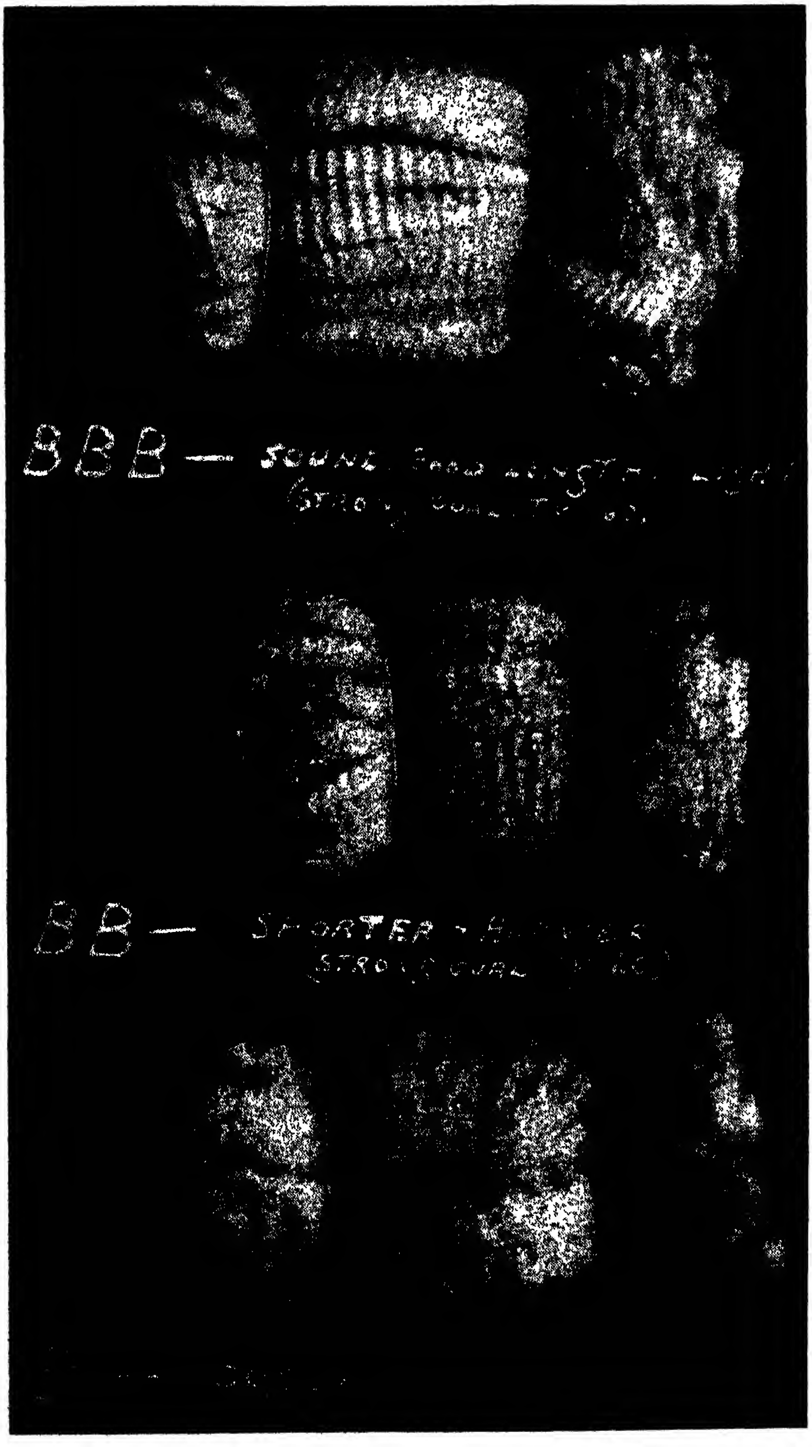
This type of bin could also be made of ½ in. piping.

ESTABLISHING THE LINES.

The decision as to how the clip is to be classed, what lines to make, etc., has to be made during the first day's shearing, and the importance of the first day's work in setting the lines correctly—or laying the correct foundation on which to class—cannot be over-emphasised. The most difficult part of classing any clip is during the first day, when it is necessary to set out or match together a few fleeces into those lines or grades which only are warranted and which are sufficient to cater for the whole clip. It is necessary for the fleeces in these grades to be sufficiently even that they will blend profitably as a line, and the number of grades or lines must be sufficiently few to enable reasonably big lines to be made in the clip.

It is recommended that the main objective during the first day's shearing should be "to get the eye in" to the wool coming off and the correct setting up of the lines to be made. Plenty of time spent in this direction is well spent and will save time and uncertainty and eliminate irregular and unprofitable classing as shearing progresses.


AAA COM—
FF COM—


BBB —
BB —

Before setting the lines it is a definite advantage to get the "feel" of the clip first, by stacking the first 40 or 50 fleeces in the corner of the shed or in a spare bin as they are shorn—after an examination and handling on the wool rolling and classing tables. These fleeces can be classed out later when the lines have been made. Having a good "look" at the wool in this way before establishing the lines, assists in a correct appraisal of the average quality and type of the wool to follow and assists to "get the eye in" quickly to the correct matching of the next 30 to 40 fleeces into established bulk lines, which will absorb the majority of the clip. Becoming familiar with the wool in this way at the outset eliminates much uncertainty and changing of fleeces afterwards when the lines are being established.

Matching.

Woolclassing is only another name for the matching into lines of fleeces that are similar in length, quality, condition and soundness, and naturally fleeces that are similar in these characteristics will go together. Matching that is more true and more quickly performed will follow an observance of the "golden rule" of all wool work, i.e. the first impression is the best.

Quality.

Quality refers to the thickness of the fibre (count). Merino qualities or counts used are 70's (fine), 64's (medium), 60's (strong). Do not be concerned with the figures or counts when classing, but be guided by the crimp formation and general appearance, and think in terms of fine, medium and strong wool. Narrow crimping denotes fineness and broad crimping, strength, or thicker fibres.

As far as quality is concerned, fine and medium fleeces can go together, but it is most important where practicable to keep strong quality fleeces (60's) out of the medium and fine wool lines. It is more important to keep the odd strong fleeces (60's) out of the medium fine lines than the odd 64/70 fleeces out of the strong lines (60's).

Extra strong fleeces of lower than 60's quality and "doggy" fleeces should be kept out of all the main lines. If there is not enough for a bale these types can be bagged or baled with other "outsort" fleeces into a mixed bale and sent to the brokers for bulk classing.

Outsort Fleeces.

Outsort fleeces embrace all those irregular and inferior fleeces which will not match the main lines; the value of which is lowered if they are left in. These irregular fleeces include the matted, overstrong, very discoloured, doggy, rams, black tipped, rotten, heavy and fatty, very short types, etc. There are always a number of these cast fleeces in every clip.

Quality Affects Values.

Quality, or fibre thickness, is under present world demand the most important factor in determining the value of merino wool today, and this position is likely to remain for some years to come. World stocks of 64's and finer are low and are likely to remain so, as these types are going into consumption faster than they are being produced. This position is reflected in the keen demand and high prices paid for these types during the last woolselling season.

To receive maximum returns under present auction conditions classing should be modified accordingly, and more attention must be paid to quality when classing than hitherto, and where practicable strong quality fleeces (60's) kept out of the medium and fine quality lines (64's and 70's.)

Under the Appraisement Scheme only a small price margin existed between fine, medium and strong merino wool, and length was more important than quality, but the reverse applies today. This is illustrated in the following table of clean limits for "good topmaking" style wools. The "good topmaking" style of wool applies to the big bulk of farmers' clips which are valued under this type.

Good Topmaking.

Appraisement Limits.		Present Limits.	
Quality.	Clean.	Quality.	Clean.
70's	$30\frac{1}{2}$d. lb.	70's	130d. lb.
64's	$29\frac{1}{2}$d. lb.	64's	124d. lb.
60's	$27\frac{1}{2}$d. lb.	60's	109d. lb.

(*Note.*—These were values at Sale on 14th June, 1948.)

Under Appraisement limits and working on a 60 per cent. yield, the difference (greasy) between a 64 and a 60 of this type would be :—

$$\left.\begin{array}{lll} \text{64's} & 29\frac{1}{2} \times \frac{60}{100} = & 17\frac{7}{10}\text{d.} \\ \text{60's} & 27\frac{1}{2} \times \frac{60}{100} = & 16\frac{1}{2}\text{d.} \end{array}\right\} 1\tfrac{1}{4}\text{d. lb. in favour of 64's.}$$

As compared to present limits :—

$$\left.\begin{array}{lll} \text{64's} & 124 \times \frac{60}{100} = & 74\frac{2}{5}\text{d.} \\ \text{60's} & 109 \times \frac{60}{100} = & 65\frac{2}{5}\text{d.} \end{array}\right\} 9\text{d. lb. in favour of 64's.}$$

Length.

This refers to the average length of the staple and when classing merino wool it is necessary to think in terms of :—

Good Length $3\frac{1}{2}$ to 4″ (Warp)
Medium Length $2\frac{1}{2}$ to 3″ (Half Warp)
Short Under $2\frac{1}{2}$″ (French Combing)

In years when seasonal conditions are good, warps (bulk top line) naturally will be plentiful. However, when the clip is not well grown all the wool will be correspondingly shorter in staple and the half-warps would be the bulk top line.

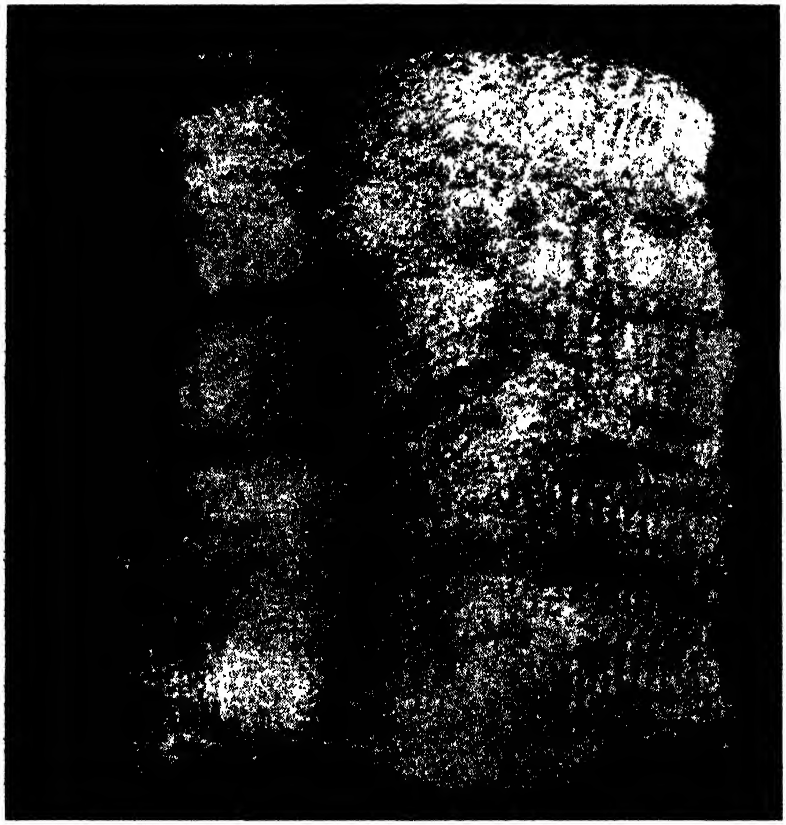
Condition.

This refers to the amount of yolk etc., in the wool and it is necessary to differentiate between light, medium and heavy variations in condition. It is necessary to lift the fleece off the classing table to arrive at a reliable estimation of its condition. Do not be misled by colour when estimating condition. A bright fleece is not always light conditioned and a fleece that is "off colour" (not bright) is not always heavy conditioned.

All fleeces with a pronounced heavy black tip and heavy fatty fleeces must be kept separate and not included in the medium conditioned lines.

Soundness.

This refers to the tensile strength of the fibre which is subjected to tension during the combing process. This strain is about equal to a 7 lb. tension on the average staple of wool. Sound wool will withstand this approximate 7 lb. pressure when applied by hand. Unsound or tender wool will give or break under the strain. Inconsistency and errors of judgment will occur when testing wool for soundness, unless the same tension is applied to the same thickness of staple for each fleece.



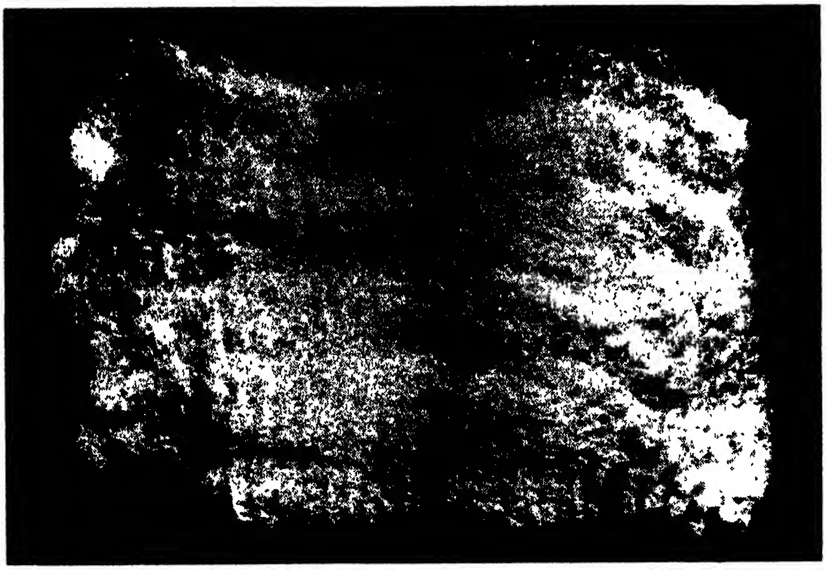
AAA FLC—Tender wool fibres have broken under tension.

To test for soundness, grasp the tip of the staple between the thumb and forefinger of the left hand and the butt of the staple between the same fingers on the right hand, and apply a steady pressure of about 7 lbs. Keep all tender fleeces out of the main sound lines. If there are not enough tender fleeces for a bale or a line, bag them or make a mixed bale with other "outsort" fleeces for the bulk class.

If the big majority of the fleeces are tender, ignore this factor and class on quality, length and condition.

Number of Lines to Make.

The number of lines made is dependent upon the size of the flock and the amount of wool to be handled. Lines as big as possible should be made and overclassing should be avoided. Under the present auction conditions, experience indicates that a few big lines of fleece wool that are reasonably even, are more profitable than a number of small lines. In these bulk lines, the top fleeces "carry" the average fleeces with the result that generally a higher *average* price per lb. results than if the wool had been classed out closely into smaller and probably more uniform lines.



BREAK IN WOOL, i.e., rotten.

To receive full advantage of classing in this manner however, great care must be taken to keep out of the bulk lines the odd irregular fleeces that do not match.

When setting or establishing the lines, do not set the standard of the top line too high, set the standard according to the wool before you, and have a good distinction between the tops and seconds. *Make plenty of top line* even if it is not as good as you would like—the second line will by comparison be correspondingly inferior in appearance and lower in value if the lines have been soundly established. Big top lines are not possible if the standard is set too high at the commencement of shearing. Big top lines are profitable and *increase the average price per lb. over the whole clip.*

The *average price per lb.* is more important than the individual price per lb. for various lines, and it is *the* important factor as far as total cash returns are concerned.

Description and Number of Lines

Lines can be made from the following description, according to the size of the flock, and for larger clips extra lines may be made where warranted.

SMALL MERINO FLOCKS OF UP TO 500 SHEEP.

AAA COM	Longest, brightest and lightest
AA COM	Shorter, heavier and less attractive. All outsorts (rough, very fatty, very tender and rams etc.) to be put into bags or mixed bales
AA PCS	One line, stains removed
AA BLS	One line, stains removed
STD PCS	
LKS	
AAA LAMBS	One line, stains removed

FLOCKS OF 500-1,000 SHEEP AND OVER

AAA COM	Sound, good length, light condition (fine to medium quality)
AA COM	Sound, shorter, heavier (fine to medium quality)
BBB	Sound, good length, light to medium condition, strong quality
AAA FLC	Average length, fine to medium, tender
AAA BKN	Backs and necks
AA PCS	Pieces. Stains removed
AA BLS	One line. Stains removed
STD PCS	One line. Dags removed
LOCKS	One line. Dags removed
AAA LBS	Longest. Stains removed
AA LBS	Shorter. Stains removed

COMEBACK AND CROSSBRED FLOCKS OF UP TO 500 SHEEP.

AAA CBK *or* AAA XB	Finest to medium quality
AA CBK *or* AA XB	Medium to strong quality. Outsorts, such as cotty, discoloured and faulty fleeces to be kept separate
AA PCS	One line, with stains removed
AA BLS	One line, with stains removed
STD PCS	
LOCKS	
CBK LBS	Fine quality, stains removed.
XB LBS	Medium to strong quality, stains removed.

COMEBACK AND CROSSBRED FLOCKS OF OVER 500 SHEEP.

AAA CBK *or* AAA XB	Good length, light to medium condition, fine quality.
AA CBK *or* AA XB	Good length, light to medium condition, medium quality.
A CBK *or* A XB	Shorter, heavier, fine and medium quality.
AAA CBK FLC *or* AAA XB FLC	All tender fleeces.
XB	All very strong quality fleeces. All cotty, discoloured and very rough fleeces into bags.
AA PCS	One line, stains removed.
AA BLS	One line, stains removed.
STD PCS	One line, dags removed.
LKS	One line, dags removed.
CBK LBS	Fine.
XBD LBS	Medium to strong. Short Lambs and Lamb skirtings into bags.

Picking Up and Throwing.

If the fleeces are picked up and thrown correctly, the whole "get up" will benefit because the fleeces can be skirted much more efficiently and expeditiously when they are thrown so that they lay flat on the table.

A little time and trouble spent by the picker-up in this important aspect of shed work is reflected in better work and better classing throughout the shed. A little attention to straightening and disentangling the points of a fleece as the shearer is finishing the last few blows can, and does often, mean the difference between good and bad throwing, and consequently good and bad skirting and backing.

Frequent use of the broom should be made by the picker-up to avoid dags, second cuts, sweaty ends, etc., from the previously shorn sheep being gathered into the fleece as it is picked up.

Skirting and Backing.

Maximum returns are dependent upon efficient skirting and it is essential that fleeces are carefully skirted for sweat, stain, seed and burr, and also any rough breech pieces. Discretion must be used as to the depth or amount of skirting necessary. The volume of skirtings removed can vary with seasonal conditions, which govern the amount of seed and/or burr, dust and foreign matter in a fleece.

Careless or faulty work at the wool-rolling table can result in over skirting, which is definitely unprofitable. Over skirting builds up the piece lines at the expense of the more valuable fleece lines—in other words it *increases* the quantity of *lower* priced wool and *decreases* the quantity of *higher* priced wool.

Those portions of the back and neck wool which are too thin, short, dusty, etc., to match the rest of the fleece, should be removed, and inspection on the rolling table with the tip side up is essential to determine the degree of backing necessary. Indiscriminate removal of backs and necks is unprofitable and results in much wool which could have been typed as fleece, being relegated to a broken type at a lower value. Profitable classing calls for as much fleece wool in a clip as possible.

When backs are removed and a line is made, this wool must be kept separate and branded BKN.

Wool Rolling.

Neat, compact, well rolled fleeces with the shoulder wool wrapped around the fleece have definite advantages lacking in slovenly and carelessly "rolled" fleeces. These advantages are:—

1. The wool opens up more attractively on the showfloor.
2. Handling is facilitated when carrying to the bin and when pressing.
3. A greater degree of consistency and evenness in the classing and better distinction between the lines is facilitated.

Pieces and Bellies.

Piece and belly lines in *all* clips should be free of urine stains, second cuts and locks. It is not advisable to make more than one line of pieces and bellies in small clips, but in larger clips it will pay to pick the pieces and bellies, and two lines can be made where warranted.

Pieces should be thoroughly shaken to eliminate locks and second cuts. Piece lines that are locky will go down in type, yield and value.

Locks and Stains.

At the present high levels these types warrant more attention than they usually receive. The stained piece line should take only urine and excretion stains from the breech end of fleeces, together with belly pizzle stains. If the stained content is heavy due to lack of crutching, lush season etc. breech skirtings should be trimmed carefully, because the presence of over much clean wool in stained piece lines is unprofitable, and clean piece lines containing stains will be reduced in value as a result of this fault.

Locks should be shaken in order to eliminate dags and pieces. The inclusion of dags results in the paying of freight on something that is worthless, and the pieces will bring more money if included in the piece line.

Lambs.

Only one line should be made in small clips. Where warranted, two lines can be made, grading the wool for length and aiming at a good distinction. It is important to keep lamb lines free of urine stains—ignore sweat.

Brands.

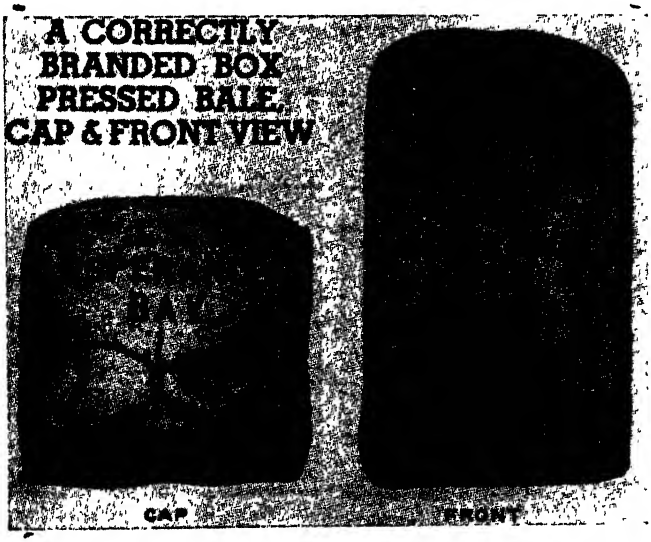
Where woolbrand fault is excessive and prevalent, the brand should be removed and bagged separately from the other wool. When brands are completely removed it is advisable to notify the broker accordingly.

Downs Type of Wool.

As most of the Downs wool types carry brown, black or grey fibre, it is important that it is not mixed with any other wool. Wool of this type should be branded according to breed and bagged if there is insufficient for a bale. Where growers of fat lambs of the Downs breeds have a number of lambs left on their hands that are shorn at the general shearing, the wool when shorn should be kept strictly apart from other wool, and placed into bales or bags without skirting.

Pressing and Branding.

Neat, well pressed bales facilitate handling, save packs and are a general all-round advantage. When pressing it is advisable not to make the bales containing top line wool too heavy. It is an advantage also if the weights of such bales are kept fairly even and without a great variation in poundage. The conservation of wool packs is an important item at the present high price for packs, and a reasonable high overall bale average is necessary in order to conserve packs. This can be effected by increasing the weights in the lower or inferior lines, which will not lose anything in appearance when opened up, through heavy, but not excessive, bale weights.



The bales in the clip must be numbered consecutively from number one on to the end of the clip with oddments following in sequence. Do not duplicate numbers in any one season.

It is recommended that a plain brand which is distinctive and bold be used with the owner's initials over the name of the property. The initials serve as a distinguishing mark as many farm names are duplicated. Stencil plates only should be used, and the letters of same should not be too small. Do not use horse, cattle, wheat and wool brands.

The brand, description and bale number should be clearly marked on the front and top of each bale. Do not brand on the bottom of the bale as this is required for shipping marks. The front of the bale should be the side with

the seam all round. Where no mechanical press is available and fixed top packs are used, the same method applies, but the *front* of the bale should be opposite to the side to which the cap is attached.

The minimum weight of a "full weight" bale of greasy wool is 200 lbs.—bales containing less than this are sold on their own separately as "light weights" at reduced rates.

It is recommended that the classer or grower sends the wool broker a brief report on the clip, giving the bale numbers of any "splits" in the flock and stating where and at what bale number a change has occurred in the wool. This could occur through a change in country, a different paddock, or a change of flock during shearing.

OAT AND BARLEY TRIALS, 1946-1947.

DURING the above period, six oat and barley trials were conducted at various centres in the south-west. The results of these trials in hay yields per acre, are given in the following table:—

Farmer.	District.	Year.	Algerian.	Dale.	Fulghum	Guyra.	Ballidu.	Wongan.	Atlas.
W. A. Beaney .	Denmark .	1946	0.69	0.37	0.53		0.61	0 63	0 32
Denmark R. S.	Denmark .	1946	1.67	1 43	1.11		1 15	1 03	
W. Dempster .	Cowaramup	1946	0 81	1.01	0.87		0 65	1 05	1 05
J. Hanks	Harvey	1947	2 84	1 46	2 40	2.05	2 68	1 32	
H. Manson	Jardee .	1947	2.70	3 06	2.76	2 20	2 18	1 62	
W. K. Walters	Bridgetown	1947	4 60	3 40	3 20	4 10	2 30	2 50	2 50
Total		.	13.31	10.73	10.87	8.35	9 57	8 15	3 87
Mean		.	2 22	1.79	1.81	2 78	1 59	1.36	1 20
Per cent.			100	80 6	81 5	125 2	71.6	61 2	58 1
No. Trials			6	6	6	3	6	6	3
		In Tons /Acre.							

From the above Table it will be seen that of the six varieties of oats, five of them were included in six trials and one was included in three trials which were conducted during 1947. The Atlas barley was only included in three trials.

The results show that Algerian oats have given reasonably good yields throughout, but the variety Guyra which was only grown in 1947 has out-yielded all the other varieties, but on analyses it will be seen that it still did not give the yield of Algerian for the year 1947.

Barley and Wongan oats have given the lowest hay yields for the two seasons.

The following gives the information of each trial as supplied by the District Officer:—

1946. *W. A. Beaney, Denmark.*—Trial conducted by C. Tobin, Dairy Instructor, Denmark.

Seasonal conditions in 1946 were unfavourable for the trial and results were therefore disappointing.

Opening rains did not fall until May when the trial was sown. Following the sowing, very cold weather set in causing germination and growth to be slow and weak. For this reason it was not possible to graze the plots.

Harvesting was carried out on the 31st October and 10th November, with Algerian and Dale varieties being the last harvested.

1946. *Denmark Research Station.*—Trial conducted by V. Weston, Manager Research Station, Denmark.

This trial was not grazed at any time owing to adverse season.

The site selected had a fair slope from east to west which should have ensured good drainage. This however, was not the case. A considerable area particularly on the north and south sides, was waterlogged until the late spring.

At harvesting, all varieties were very patchy with a stunted growth of 18 inches to 24 inches on the waterlogged patches, and a well-stooled growth about four feet high on the central well-drained ridge running crossways through the plots.

The barley gave no results as pests kept this down during the early stages and allowed weeds and grasses to choke it out.

All varieties started heading between 16/9/46 and 19/9/46. Green weights were taken on 23/10/46 for Fulghum, Wongan, and Ballidu, and on 28/10/46 for Algerian and Dale, as these were later varieties.

In the green weight estimation a four foot six inch mower cut was taken for six chains through the centre of each plot. The entire six chains were picked up, sheafed, weighed and then stooked.

The later maturing varieties, Algerian and Dale, appear to give the best results particularly in the hay yields.

1946. *W. Dempster, Cowaramup.*—Trial conducted by V. Monti, Dairy Supervisor, Margaret River.

Oats and barley varieties were sown on the 3rd June. The rate of seeding was oats two bushels per acre, barley one and a half bushels per acre, with one bag of superphosphate. Each variety was sown in triplicate giving a total of 18 plots in all.

Inspections prior to harvesting showed that plots one to seven were giving better growth than plots eight to 18. This variation was due to the dry season and the fact that plots eight to 18 were on higher ground which tended to dry out.

Three grazings were carried out during the early part of the season and the last grazing was at the end of August.

Harvesting was done by a four and a half foot mower on the 19th November and green weights obtained. Seven days later on 26th November, hay weights were taken as by this time the hay was fit for stacking.

1947. *J. Hanks, Harvey.*—Trial conducted by G. Gauntlet, Agricultural Adviser, Harvey.

This trial was planted on the 20th May on an area nine chains by five chains. Six varieties of oats were sown in triplicate giving a total of 18 plots. All oats were sown at rate of two bushels per acre and superphosphate was applied at the rate of two cwt. per acre.

Owing to excessively wet conditions occurring early in June, the plots were partly spoilt by waterlogged conditions. The results gave a fairly good indication as to what the plots looked like. Owing to the waterlogged and boggy nature of the ground grazing was not carried out at any stage of growth.

The variety Algerian was consistent in growth throughout the three plots. The growth and yield average of Fulghum was spoilt by a badly waterlogged plot, but this variety appears to be suitable for the general conditions in this area.

Ballidu was erratic in growth while the Guyra was fairly uniform and consistent. Wongan and Dale do not appear to be suited to the conditions, as being fairly early varieties they matured before harvesting could be carried out. These varieties may do better if grazing could be carried out on the early growth or if sown after the July rains.

1947. *H. Manson, Jardee.*—Trial conducted by J. McNally, Dairy Adviser, Manjimup.

This plot was a hillside originally timbered with karri and red gum. Settlement of the farm took part in the period that the Group Settlement Scheme was introduced and from then on the area was partly cleared. For over five years the farm was only used as a grazing proposition and it is doubtful whether any fertiliser was applied during that period.

When the farm was occupied by Mr. Manson, the plot in question was carrying a heavy crop of bracken fern; this was slashed, burnt and the ground ploughed; the oats were planted on the ploughed ground at the rate of two bushels per acre, cultivated in with scalloped disc, which made a good seed bed. Date of planting was 21st May, 1947. Fertiliser at rate of two cwt. superphosphate, plus five pounds of copper per acre.

An inspection at the end of July when the oats were above nine inches high showed that bracken fern was coming away rapidly and a subsequent inspection showed that the ferns were checked and that the oats were growing with renewed vigor.

Later in the season, patches of oats showed signs of some trouble, the leaf tips withering, extending back to the stalk and finally the leaf dried up. Other leaves began to wither in the centre, whilst others showed a ribboning effect: that is light and dark green markings, extending the full length of the leaf, indicating the possibility of both copper and manganese deficiencies.

As the weather warmed up, much better growth was made by all varieties, although patchiness was still evident.

The varieties sown were Dale, Ballidu, Algerian, Fulghum, Wongan and Guyra, all varieties gave a very good germination. Rabbits were bad at various times during growth and seemed to pay particular attention to Guyra; this was noticeable particularly later in the season. Ballidu, Fulghum and Wongan matured about two weeks earlier than the other varieties. The plots were planted on the randomised system with three replications of each variety.

1947. *W. K. Walters, Bridgetown.*—Trial conducted by K. W. Simes, Dairy Instructor, Bridgetown.

The soil was typical of that found in the district, a fairly deep, red loam on a gentle slope to the river. The land had been cleared for a considerable

number of years and given alternatively over to pasturage and cropping. The field occupied 10 acres and the trial covered an area of seven acres.

Rainfall.—Average 33 to 34 inches. In the season 1947, 41.27 inches were recorded.

The oat varieties, were Wongan, Algerian, Dale, Fulghum, Ballidu and Guyra, and together with an acre of Atlas barley were sown in triplicate.

The land was ploughed very early in the season and worked with a disc cultivator and harrows to reduce weed growth. The seed was drilled during the last week in May. Sowing rates: Oats two bushels per acre, barley one and a half bushels per acre. Fertiliser was applied at the rate of one bag per acre (coppered superphosphate).

Within 10 days there was a good germination of all varieties and from subsequent observations it was difficult to select any particular variety of oat that was making better growth than others. The barley was disappointing. It is possible the wet conditions which prevailed did not suit the crop. Portions of the area in which the barley was sown were not well-drained and the plant roots were affected.

During the early spring months, the Guyra, Fulghum and Dale varieties forged ahead and came into ear. The Algerian did not do so well but towards the close of the spring they made very rapid growth and from a cursory examination appeared the best oat in the field.

Crop estimates were made in mid-November.

THE CONTROL OF ROOT-KNOT OR EELWORM-GALL DISEASE BY SOIL FUMIGATION WITH D-D.

W. P. CASS SMITH, Government Plant Pathologist.

H. L. HARVEY, Assistant Plant Pathologist.

ROOT-KNOT or eelworm-gall is a serious and destructive root attacking disease. It is caused by a parasitic eelworm or nematode (*Heterodera marioni* Cornu, Goodey) which is world-wide in distribution. This parasite is most common and damaging in light soils during the summer months, and in this State it is particularly prevalent in the sandy soils of the Perth metropolitan area and the Geraldton district. This pest may increase costs of production considerably, for it causes a less effective utilisation of applied fertiliser and water and as a result yields are reduced. Unfortunately the root-knot disease may attack a great number of different plants, often widely separated botanically, which considerably increases the difficulty of controlling it by crop rotation. These include most vegetables, fruit trees, and ornamentals and also many pasture plants and common weeds. In general, however, cereals (such as wheat, oats and barley) and grasses are less susceptible to the disease.

SYMPTOMS.

The above-ground symptoms on affected plants include a general unthriftiness, stunting, wilting of the foliage during hot weather, and lack of a healthy green colour. Quite often plants which are wilted during the hotter parts of the day, recover and lose their wilted, limp appearance in the cool of the evening and in the early morning. In bad cases plants may be killed outright especially in the young stages.

If a plant showing the above symptoms is pulled up, numerous galls or swellings will be seen on the roots, from which the disease has received its names. These swellings which are irregular in shape, are the result of infection by the parasite, which causes an enlargement in root diameter. They should not be confused with the beneficial nitrogen-fixing bacterial nodules, which occur normally on the roots of legumes such as peas, beans, lupins, etc. On fleshy underground structures such as the tubers of potatoes and dahlias and the swollen tap-roots of carrots and parsnips, the galls take the form of elevated warts or blisters. It is in these galls that the eelworms and their eggs may be found, but being only microscopic in size they are not visible to the naked eye.

CONTROL BY SOIL DISINFECTION.

As soil in which diseased plants have been grown remains infested for some years, and adequate control by crop rotation is difficult to obtain, control by soil disinfection is sometimes practised. Various agents may be used for this purpose, the most effective being steam, which in addition to killing parasitic organisms, also kills weed seeds and increases soil fertility. Steam treatment is expensive, however, and it has been mainly used on small areas, such as seed-beds or glass-house soils. In consequence, chemical soil treatments have also been tested with varying success, including formalin, carbon-disulphide, crude naphthalene, cresylic acid, etc., and more recently outstanding results have been obtained overseas with a propietary material known as D-D*.

LOCAL TRIALS WITH D-D SOIL FUMIGANT.

During the last twelve months or so, the effectiveness of D-D for eelworm control has been tested under local conditions, at a number of market gardens and home-gardens known to be infested with eelworm. The sites chosen were in the Perth metropolitan or adjacent areas. The D-D and the injection gun used in these trials were kindly supplied by the Shell Company of Australia. In all cases the ground was prepared and treated in accordance with the recommendations set out on pp. 289-290. Although a water seal is said to be unnecessary after D-D injection, this was applied throughout after treatment, as facilities for watering were readily available. No evidence of plant injury resulting from treatment was noticed.

In the earliest trials carried out in autumn 1947, the rate of application was 5 ccs. of D-D, injected in holes eight inches deep at foot centres. (This dosage is equivalent to 580 lbs. per acre or 58 gallons approximately.) In the

* Dichloropropane-dichloropropylene.

Fig. 1.
Roots of red beets. Left, showing various sizes of eelworm galls, was taken from untreated soil. Right, showing better developed roots free from eelworm was taken from adjacent soil which was fumigated with D-D.

following spring and summer of 1947 further trials were conducted using 5 ccs. and 2½ ccs. dosages. Altogther, about 10 sites throughout the metropolitan and nearby areas were treated. In each instance considerable increases in growth were observed, the amount of the increase varying with the degree of eelworm infestation of the soil treated. Autumn treatment in one commercial vegetable garden improved yields at least fifteen-fold with tomatoes, silver beet, red beet and runner beans. Plants in untreated control rows were quite unthrifty and remained stunted to maturity (fig. 2). This particular area had become so badly infested with eelworm that it was no longer profitable for the owner to work it commercially. It is noteworthy that the sugar beet eelworm (*Heterodera schactii* Schmidt) also occurred here, in addition to the root-knot eelworm. On other sites the effect of treatment was less spectacular, but nevertheless effective. Crops grown in the tests included peas, beans, tomatoes, silver beet, red beet, carrots and parsnips.

Fig. 2.
Silver beet and red beet from D-D-treated and untreated soil on the property of Newman Bros., Coogee. The area had gone out of production due to root-knot and sugar beet eelworm infestation of the soil. (a) and (b) silver beet from treated and untreated soil respectively. (c) red beet from untreated soil. (d) red beet from treated soil.

Examinations of roots for the presence of eelworm galls have shown that in most cases plants from treated soil were almost completely free from galls, while those from untreated soil had numerous galls present on their roots. In one or two cases a few plants were found in treated soil with a relatively high proportion of galls on their roots. It is not known for certain whether this was due to fumigation not being completely effective or to later contamination with nearby eelworm-infested soil. The latter seems more probable but the matter is being investigated.

Yield counts and quality gradings were made at some of the experimental sites with the following results (see Tables 1 and 2).

TABLE I.

RESULTS AT GUELPHI AND SONS, OSBORNE PARK.

Amount of D-D per square foot.	Parsnips.		Silver Beet.	Carrots.	
	Yield.	1st Grade Parsnips.	Yield.	Yield.	1st Grade Carrots.
	%	%	%	%	%
Nil	100	33	100	100	62
$2\frac{1}{2}$ ccs.	122	67	138	107	84
5 ccs.	118	67	156	107	90

TABLE II.

RESULTS AT MR. STEVENS, BALCATTA.

Amount of D-D per square foot.	Carrots.	
	Yield. %	1st Grade Carrots. %
Nil	100	33
2½ ccs.	120	59
5 ccs.	120	61

From Table 1 it will be seen that both treatments increased yields of parsnips by about 20 per cent. and of carrots by 7 per cent. The percentage of first grade parsnips was doubled by treatment (fig. 3) while first grade

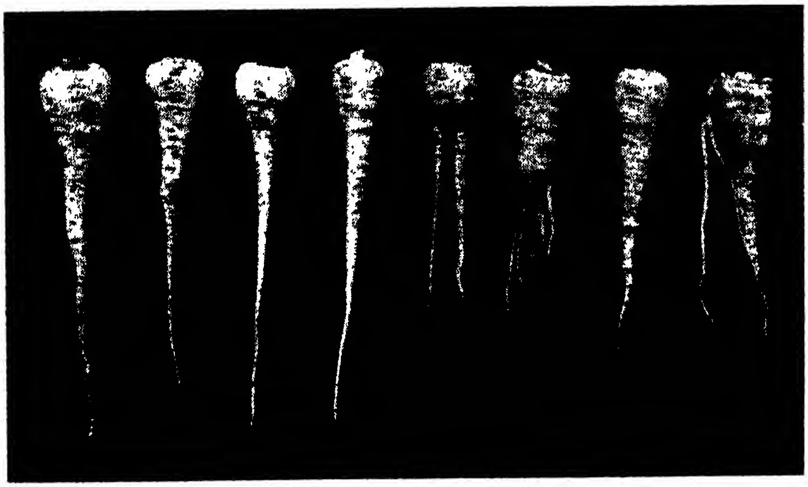


Fig. 3.
Parsnips from plots at Guelphi and Sons Garden. The inferior types on the right are from untreated soil. Those on the left are from soil treated with D-D at 2½ ccs. per square foot. See table 1.

carrots were increased by treatment to about one third to one half as much again as those from untreated plots. Silver beet yields increased by 38 per cent. with the lower dosage and by 56 per cent. with the higher dosage (figs. 4 and 6).

Table 2 shows that both treatments increased yields of carrots by 20 per cent. and doubled the percentage of first grade carrots (fig. 5).

It should be noted in regard to improvement of quality of root crops that inferior grades of carrots for example may be quite unsaleable on a well-supplied market and would, therefore, be a total loss. Carrot prices over the last two or three years have averaged about £20 per ton and at a yield of 10 tons per acre the cash return would be £200 per acre. At the time of writing the price of

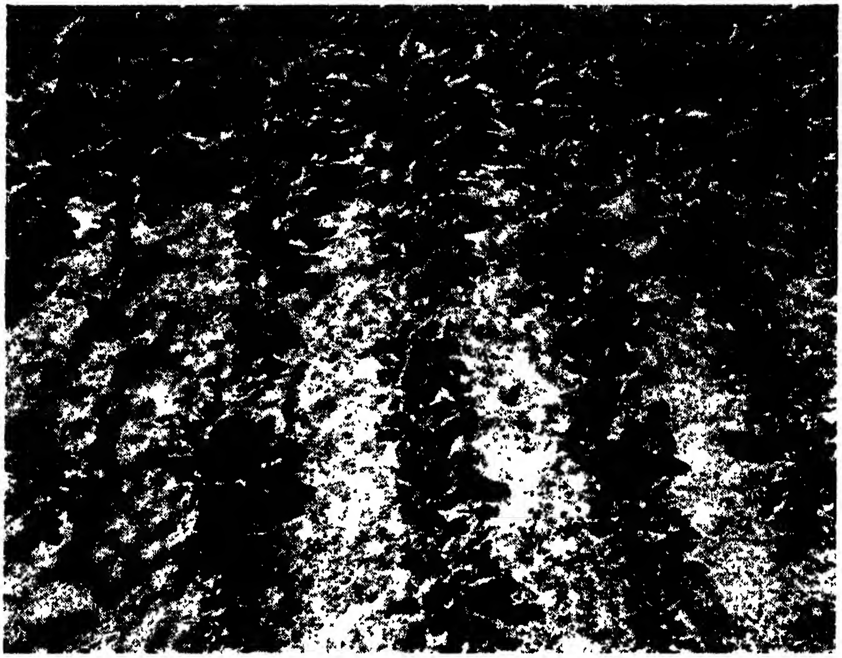


Fig. 4.
Silver beet growing at Guelphi and Sons property Plants in background are on soil treated with D-D at 5 ccs. per square foot. Plants in the foreground are on untreated soil. Yields are shown in Table 1.

Fig. 5.
Carrots grown at Mr. Stevens garden Balcatta. The undesirable types at left were grown on untreated soil. Those at right are from soil treated with D-D.

D-D is 21s. per gallon in 44-gallon lots. At 2½ ccs. per foot the amount used per acre would be approximately 29 gallons costing £30. This illustration serves to indicate the relationship between the cost of D-D and crop returns.

Fig. 6.
Market bunches (9 leaves each) of silver beet from the trial plots grown by Guelphi & Sons. Left, from untreated soil. Right, from soil treated with D-D. In addition to the difference in sizes of the bunches it was possibe to make three picks from the treated plots to every two picks from the untreated plots. Furthermore the picking life of the plants on treated plots was greatly increased.

As a result of the tests conducted to date a number of successful market gardeners have treated areas on a commercial scale in the belief that the increased returns will more than repay the cost of treatment.

In addition to the above examples of control of eelworm by the use of D-D, observations made on growth in small home garden trials serve to support the conclusion that this soil fumigant is an effective means of controlling eelworm. In home-garden soils of the metropolitan area eelworm infestation is often so severe as to make the cultivation of certain vegetables and ornamental plants impossible. Eradication of the pest by D-D fumigation would make the difference between success and failure.

RECOMMENDATIONS FOR THE USE OF D-D.

Preparation of the Soil.

Dig and prepare the ground to be treated so that it is in good condition for sowing or setting out plants. in other words, the ground should be in good tilth, not too wet or too dry. If necessary break down any large clods and allow time (say a fortnight) for residues from previous crops to rot before applying treatment. If this is not done eelworm in large clods or undecomposed root galls may escape the effects of the fumigant.

Application.

D-D obtainable from the Shell Company of Australia or agents, should be applied in holes six to eight inches deep and spaced one foot apart in staggered rows (i.e., the holes in one row should be opposite the spaces between holes in the adjoining rows).

A dosage of 2½ cubic centimetres or ½ teaspoonful of D-D per hole is adequate, at which rate approximately 160 square feet can be treated with one

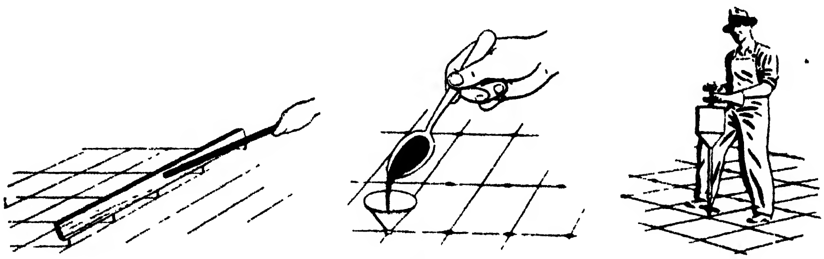


Fig. 7.

Illustration showing a convenient method of marking soil into squares prior to treatment, and two methods of injecting D-D into the soil. The teaspoon method has been practised with success by home-gardeners, and the injection gun on right is suitable for larger areas and is similar to that used in these experiments. Note that the injection centres are staggered which gives more uniform distribution of the gas throughout the soil.

(Reproduced by courtesy of the Shell Co. of Australia).

half pint of fumigant. Pour the liquid into the *bottom* of each hole (a funnel will facilitate this) and cover immediately with soil to prevent the fumes escaping too rapidly. Plastic teaspoons of accurate size are now available at many stores. For large areas a soil injection gun* is more suitable than the teaspoon method of application.

After Treatment.

If possible water the ground after application so that the surface two inches are moistened. This will prevent fumes from escaping too rapidly. Dig the ground over a fortnight after the treatment has been applied to allow the fumes to escape and plant three weeks after the initial treatment.

Precautions.

D-D should not be applied within 30 inches of growing plants whether herbaceous annuals or perennials, or woody trees or shrubs.

Avoid breathing the fumes of D-D unnecessarily, and *do not* siphon the liquid by mouth suction.

If splashed on the hands wash off with soap and water, to avoid the risk of skin inflammation. Susceptibility to this, however, varies greatly with different individuals, most being practically immune.

* Application should be made direct to the Shell Company of Australia for soil injection guns.

AUTUMN RAINFALL IN RELATION TO SPRING EPIDEMICS OF WHEAT STEM RUST.

A Note on the Occurrence of a Localised Outbreak.

By W. P. CASS SMITH, Government Plant Pathologist.

IN Western Australia ideal weather conditions in spring or early summer for the development of wheat stem rust seldom occur for lengthy periods, and in consequence serious epidemics have been infrequent. During the last forty years, only four widespread epidemics have been recorded in the main wheat-belt areas, namely in 1915, 1917, 1934 and 1943.

Attention has been drawn previously to an apparently significant relationship between autumn rainfall and the occurrence of rust epidemics subsequently in spring or early summer (Cass Smith and Millington, 1944).

It was pointed out that these rust epidemic years were characterised by unusually heavy rainfall between January and April, and especially in March, and as far as existing records showed, rust epidemics had *only* occurred in Western Australia in years such as these.

To explain this phenomenon it was postulated that in such years an autumn build-up of rust occurs on barley grass, self-sown or early sown wheat, which survives the winter, and which more readily enables the disease to attain epidemic amounts in spring or early summer, should favourable weather for its development occur.

Thus, with a short period only of favourable spring weather, which is generally the case in the Western Australian wheatbelt, the disease is most likely to reach epidemic proportions where an autumn build-up and winter carry-over of rust has occurred. There is evidence to support this theory. Infection by the stem rust fungus proceeds most freely, and its growth develops most rapidly at temperatures between 65° and 75°F. (Craigie 1940). In our wheatbelt areas mean daily temperatures within this range commonly occur during the autumn months. At this period, moisture, an absolute requirement for rust infection, is apparently the chief limiting factor both for rust development and also for the growth of susceptible host plants.

In years of unusually heavy autumn rainfall, rust has often been noted on self-sown wheat, and barley grass, which soon appear in many areas and make luxuriant growth under these conditions. The survival of the fungus throughout the winter months has also been observed in the rust gardens at the Merredin and Wongan Hills Research Stations where autumn infected wheat plants again produce uredospores abundantly in spring.

However, as rust epidemics recorded in the past have been more or less widespread and as detailed field observations have not yet been possible, it has been difficult to establish more definitely this suspected relationship between autumn rainfall and rust development in spring.

During the 1947 season circumstantial evidence strongly supporting this belief was obtained when, in the Wongoondy area, following a very local thunderstorm of 235 points in March, a severe rust epidemic occurred in spring, which was practically confined to the two farms which experienced the rain storm. The average March rainfall for this area is some 80 points and elsewhere in this district only approximately average precipitations were received.

In an interesting report on this epidemic, dated 11/10/47, Agricultural Adviser G. L. Throssell stated . . . . . "Following on reports of a rust epidemic at Wongoondy, I visited the area on the 8th and 9th of October. Unlike the epidemic of 1943 when practically the whole area was devastated, this year rust in severe form seems to be practically confined to two farms. These farms received a localised thunderstorm in March of 235 point of rain, which other farms did not get. This brought up a prolific growth of self-sown wheat, which was 12 inches high in May and obviously rusted. These two farms have been badly hit, and crops of Bencubbin totalling 600 acres have been practically wiped out. Bungulla, 400 acres, will be much reduced in yield. Rust does occur on other adjacent farms, but the infection is much less, and I don't anticipate there will be much reduction in yield as a result."

Rainfall recorded at one of the affected farms was as follows:—

RAINFALL.

H. B. MILLS, Wongoondy, 1947.

Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total.
				May.	June.	July.	Aug.	Sept.	Oct.	Total. May-Oct.			
....	.	235	96	658	266	325	126	127	260	1,762	15*		2,108

* To 19th November.

As far as can be ascertained, spring weather conditions were no more favourable for rust development at these two farms than elsewhere in the near vicinity, yet they were the only farms in the area where rust developed to epidemic amounts.

The occurrence of the Wongoondy outbreak therefore strongly supports the belief that under Western Australian conditions, heavy autumn rainfall which is conducive to an autumn build-up of rust, increases the chances of an epidemic later in spring or early summer.

In view of this it has been suggested that in such years a warning of high rust hazard could be issued to farmers prior to seeding, to enable them to plant rust resistant varieties. However, until long-range weather forecasts are available it is impossible to predict with accuracy how rust development will proceed in spring or early summer.

It should be clearly understood that if weather conditions at that time are unfavourable for rust development, no epidemic will occur, despite an autumn build-up of inoculum. A study of records will show that there have been a number of years of unusually high autumn rainfall which presumably were favourable for a build-up of rust but in which no epidemic occurred. On the

other hand it cannot be affirmed with any confidence that weather conditions will never remain favourable long enough in spring, to preclude the possibility of an epidemic in years of low autumn rainfall, even though there has so far been no record of such an occurrence.

LITERATURE CITED.

Cass Smith, W. P., and Millington, A. J.: "Stem Rust of Wheat and its Control by Breeding Resistant Varieties." J. Dept. Agric. West. Aus., Vol. XXI. (2nd Ser.), March, 1944, pp. 1-16.

Craigie, J. H.: "Studies in Cereal Diseases. XII. Stem Rust of Cereals." Fmrs. Bull. Canad. Dept. Agric. 84.

SOIL CONSERVATION METHODS FOR CONTROL OF WIND EROSION.

A Broadcast by G. H. BURVILL, Commissioner of Soil Conservation.

Printed by permission of the Australian Broadcasting Commission.

MOVING masses of air, which we commonly call wind, have considerable energy. This energy is often harnessed for man's use by means of windmills or by the sails of boats, but the uncontrolled forces of violent windstorms can, and do cause considerable damage to property from time to time. Soil erosion is often part of the damage. Thus, controlling the force which the winds can exert on the soil is one of the essential tasks in soil conservation.

Wind erosion of the soils in the agricultural and pastoral areas of Western Australia is common and perhaps extensive but, fortunately, not often very severe. It should, however, receive careful attention from landholders with affected areas (see Fig. 1).

Most of our farmlands showed no signs of active wind erosion before clearing. The scrub and trees and grass were a natural protection for the surface soil. In the same way, the establishment and maintenance of plant cover, either living or dead, constitutes the first line of attack on wind eroding areas, and the first line of defence to prevent wind erosion.

Before passing on to practical recommendations some important facts about soil movement by wind should be understood. The amount of soil erosion by wind depends mainly on the velocity and turbulence of the wind, the roughness and cover on the ground surface, and the type of soil. The general velocity of the wind over an area, and the type of soil, are mostly outside man's control. But by suitable attention to the roughness and cover on the surface, the wind velocity and turbulence near the ground can be managed to prevent soil movement.

The speed of any wind is less, close to the ground, than, say, one or two feet above it. If it can be sufficiently reduced by ridging, or by surface cover, then the wind force is insufficient to *begin* moving soil particles. Experiments

Fig. 1.

Aerial view of 160 acres of bare wind-eroded yellow sandy soil in the wheatbelt. Fences and the road in the lower portion of the picture have been buried and the drift extends on to the adjoining farm. Cereal rye was grown successfully over the whole area in 1948.

(Photo.: Kingsley Watson.)

have shown that sand grains, and the coarser soil particles, commence their movement by rolling, then suddenly jump upwards a foot or two. After this they move forward and downwards with the wind and dislodge other and *smaller* particles when they strike the surface again. The series of leaps and forward moves is called *saltation.* The whole basis of wind erosion control is to prevent or reduce saltation.

Dust clouds are composed of particles which remain suspended in the air for a long time. Most of the particles are less than four-thousandths of an inch in size. Yet such particles are not easily shifted from the ground by wind unless first dislodged by other larger grains, or by traffic or animals. Dust clouds from loamy and clay soils undoubtedly mean that some soil erosion is occurring,

but it is usually on sandy soils in this State that the more worrying type of wind erosion occurs. Surface soil removed means lowered fertility, but in addition, its accumulation in other places buries fences, roads, railways and channels. In Victoria hundreds of thousands of pounds have had to be spent each year to remove drift sand from channels which supply stock and domestic water to the Mallee areas. In South Australia, too, the control of sand drift on to roads and railways in the Mallee areas is a major task (see Fig. 2).

Fig. 2.
In the Mallee areas of South Australia and Victoria, sand drift, as shown, has become a serious problem.
(Photo.: International Harvester Co.)

It is apparent that keeping a reasonable cover of living or dead herbage on the soil surface is the best insurance against wind erosion. This means avoiding overgrazing and improving of pasture cover by topdressing and by growing the most suitable pasture plants for the soil and climatic conditions of the locality. For the sandy soils of the scrub plain and mallee areas, subterranean clover, lupins, Wimmera rye grass and oats appear at present most suitable.

If sandy or light soils are fallowed they should be left rough and with ridges if possible, across the direction of the most common strong winds. Fallowing should not be done on areas that have already shown a definite tendency to drift when bare, unless a special effort is made to protect the surface with straw or trash (see Fig. 3). In the Victorian Mallee a common practice is to scratch in oats for grazing in the fallow year, and to do the fallowing late in the season so that the remains of the oat crop help to protect the surface and produce a "bearded" or "trashy" fallow. Choice of implement and speed of working can be important. Some disc ploughs leave too smooth a surface if worked too fast. Scarifiers ridge the ground and do not bury all the weeds or stubble and may therefore be used with advantage.

Fig. 3.

When sandy surfaced soils are cultivated for crops special methods may be necessary. These pictures from sandy scrub plain land show:— Left: Remains of grazed, scratched in oat crop. Middle: Similar grazed oat crop scarified in October to leave ridged trashy surface. Right: Normal fallow, disc ploughed in July, leaving an almost bare surface which blows flat and erodes.

(Photos: G. H. Burvill.)

Where serious wind erosion has already occurred, leaving scoured areas in places and mounds of drifted soil in others, special measures are necessary to achieve control. Cereal rye has proved a suitable crop for drifting sands because of its ability in the seedling stage to recover from the sand blasting which usually occurs (see Fig. 4). Added advantages which rye has, are its capacity for growth on poor soils and its tough straw when mature. There are many bare eroding areas of varying size among the sandy scrub plain areas of the wheatbelt which could be stabilised and reclaimed with rye, followed perhaps later by subterranean clover where the rainfall is sufficient. Cereal rye should be planted at 30 to 50 pounds per acre with eighty to one hundred pounds of

Fig. 4
Cereal rye is a hardy crop for poor soils and drifting sands. Its seedlings withstand sand blast much better than wheat, oats, or barley.
(Photo: Government Printer.)

superphosphate. A disc drill used when the sand is moist after rain allows rather loose drifts to be sown. No grazing should be allowed in the year of planting. Some sandy areas where erosion was troublesome have also been stabilised with West Australian blue lupins, planted originally with a cereal (see Fig. 5).

No discussion of wind erosion would be complete without mention of windbreaks and shelter belts. There is a common belief that the planting or leaving of belts of scrub or trees at fairly wide intervals across the countryside would control wind erosion. Such belts of scrub or timber have great value as windbreaks and shelter for stock, homes and sheds. Their effect in reducing wind velocity close to the ground is limited, and may not extend beyond a distance five to ten times the height of the scrub or trees. Belts of scrub, mallee, or timber one to five chains wide are worth serious consideration for protecting roads and fences from drifting soil, and as shelter and shade for stock (see Fig. 6).

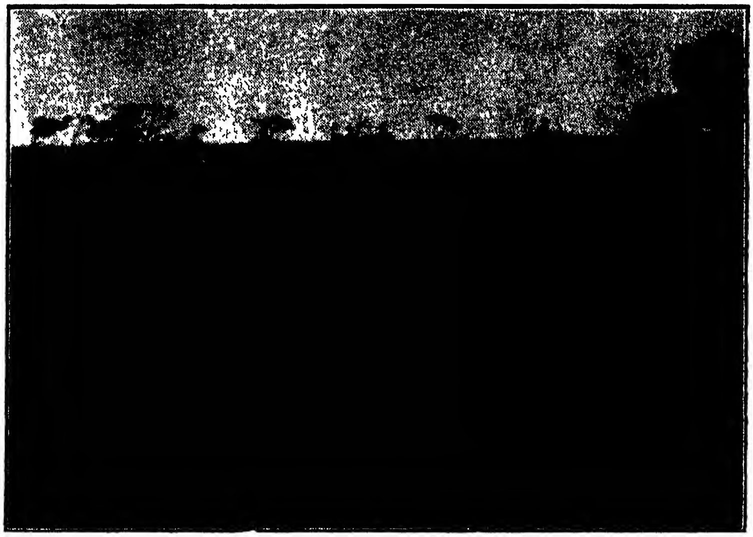


Fig. 5.

Thin stand of barley and oats with scattered W.A. blue lupins on an area at Irwin from which at least a foot of soil had blown. Even a sparse plant cover can stop wind erosion.

(Photo.: L. J. H. Teakle.)

Fig. 6.

Belts of scrub and mallee along boundaries and fences can provide shelter for stock and protect fences and roads from any drift which occurs. In this picture drift sand from the cleared area to the left has formed mounds extending about half a chain into the natural scrub.

(Photo.: G. H. Burvill.)

The protection of broad areas of crop and pasture lands from wind erosion must, however, depend on careful management in the pasture periods and suitable methods of cultivation when crops are grown.

In the interests of soil conservation, and to prevent damaging erosion which might occur, a number of Road Boards and farmers' organisations are quite keen to see legislative control of land clearing. This applies especially to our sandy scrub plain lands in the wheatbelt, on which examples of sand drifts menacing, or covering, fences and roads are all too common (see Fig. 1).

Stock Foods.

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.							
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5)	Lime.	Other.	
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% Ca		
A.—SIMPLE FOODS.												
1.—*Meat Meals.*												
Meat Meal	31	WRIGHTS ..	Wrights, Ltd.	Animal fat and bone	40·00	11·00	1·50		14·00	.	.	..
Do.	52	W.A.M.E.	W.A. Meat Export Works	Meat, bone and blood	45·00	13·00	2·00	.		.		.
Do.	110	W.A.M.E., ALBANY	W.A. Meat Export Works, Albany	Animal offal .. .	53·00	20·00	3·00	.	.		...	.
Do.	141	COOGEE .	Anchorage Butchers Pty., Ltd.	Waste meat products ..	36·90	18·60	1·30	1·00	12·73	11·43	.	....
2.—*Meat and Bone Meals.*												
Feeding Meal and Bone Meal	54	CHAMPION ..	Sims Cooper (Freezing Works) Pty., Ltd.	Meat Works offal ...	50·00	12·00	5·00		..		.	..
Meat and Bone Meal	29	PENNELLS .	C. A. Kirkby & Sons.	Animal waste .	50·00	12·00	4·00	..	.	..	.	.
Bone and Meat Meal	47	KITCHEN'S ..	J. Kitchen & Sons Pty., Ltd.	Animal fat and bone .	40·00	11·00	2·50	.	14·00	..	..	..
Fortified Protein Meal	55	IMPERIAL	W. Angliss & Co. (Aust.), Pty., Ltd.	Meat, bone, livers, and animal offal	50·00	12·00	2·00	...	.	..	...	....
Meat and Bone Meal	101	EXCELSIOR .	Barrow Linton & Co. ...	Meat and bone	38·00	15·00	1·50	.	..	..	.	...
Do. do.	81	S.M.P. .	W. R. & N. N. Clarke ..	Meat offals . . .	50·00	13·00	2·00	...		...	....	..
Bone and Meat Meal	146	APOLLO	J. Kitchen & Sons Pty., Ltd.	Animal fat and bone	40·00	11·00	2·50	..	14·00	..	....	....
3.—*Fish Meals.*												
Crayfish Meal ...	1	CHAMPION BAY	Logie Sons & Duncan	Crayfish offal	27·50	2·50	8·00	..	...	..	...	....
Fish Meal	109	W.A.M.E. ALBANY	W.A. Meat Export Works, Albany	Fish wastes and offals	53·00	10·00	1·00	.	6·11	5·90	..	....
4.—*Milk Foods.*												
Dried Buttermilk Powder	25	SUNNY WEST	South-West Co-op. Dairy Farmers, Ltd.	By-products of butter manufacture	32·10	(Min.) 5·70	..	.	...	....		....
Krafco	50	KRAFCO .	Kraft Walker Cheese Co. Pty., Ltd.	Prepared from whey derived from milk in cheddar cheese manufacture	10·00	0·50	..	..	1·00	0·50	Lactose 68·00	Riboflavin 25 u/gm
Lactocraft	56	LACTOCRAFT	do. do. do.	do. do. do.	10·00	0·50	...	....	1·00	0·50	68·00	25 u/gm.
Buttermilk Powder	82	SOUTH AUSTRALIAN FARMERS UNION	W. R. & N. N. Clarke ...	Butter milk	41·00	6·00	....	....	....	....	40·00	....

5.—Wheat By-Products.												
Wheaten Meal	44	BRANATO	W. Thomas & Co. (W.A.), Ltd.	Wheat ..	8·00	..	9·00	....	....	....	....	....
Do. ...	45	POLLATO	do. do. do.	do.	8·00	..	9·00	...	....	.	...	....
Do.	46	"C" MEAL ...	do. do. do.	do.	8·00	..	9·00	..	...	....	..	....
Wheat Meal ..	70	MILLERS ..	W. H. Milne & Co.	do.	8·00	.	5·00	..	....	..	..	....
Sub-bran	71	do. .	do. do. do.	do. ..	8·00	.	9·00	....	...	..	.	....
Stock Meal .	72	do.	do. do. do.	do. .	8·00		5·00	.	...	..	.	....
Wheat Meal .	133	WESFARMERS	Westralian Farmers Co-op., Ltd.	do. .	8·50	1·00	3·00	..	...	..	....	...
Roller Bran .	134	do.	do. do do.	do.	8·50		9 00	..	..	..	...	...
6.—Oil Seed Meals.												
Pure Linseed Oil Meal	51	MEGGITTS .	Elder Smith & Co., Ltd.	Pure linseed from which proportion of the oil content has been extracted	30 00	4·00	10·00	..	.		.	....
Lin Meal . ..	61	WESTERN .	David Gray & Co Pty., Ltd.	Linseed meal, yeast meal, bone meal. limestone. malt	22·50	7 00	5·00	...	..	0·50	...	..
B.—COMPOUND FOODS.												
1.—Protein Meals.												
Quicklay .	16	THOMAS .	W. Thomas & Co. (W.A.), Ltd.	Yeast, fish meal, meat meal, liver meal, and, or dried blood, milk powder, pollard, salt, ground limestone	35 00	(Max.) 12·50	4·00	3 00	.	15·00	..	..
Egg Protein .	22	do.	do. do. do.	Fish meal, meat meal, and/or blood meal, liver meal, milk powder, salt, ground limestone	42 00	15 00	4 50	8 50	.	15·00	.	
Quickgrow ...	23	do.	do do. do.	Meat meal, blood meal, salt ground limestone, pollard	25 00	19·00	2·60	2 75		15·00	.	..
Poultry Pusher	33	PANNIFEX	Wrights, Ltd. ..	Barley, oats and rice brannings, pollard, bols refuse, bran, flax, linseed. wheat polishings, meat meal, rape seed meal, blood meal	32 00	(Min.) 7·00	8 00		.	Trace	...	.
Egg Food	60	WESTERN	David Gray & Co Pty., Ltd.	Meat meal, blood meal, liver meal, linseed meal, bone meal, yeast meal, malt	30 00	10·00	4 00		.	0·50		.
Eggoleen	102	EGGOLEEN	Barrow, Linton & Co. .	Meat meal. cereals and minerals	37 50	(Max.) 12 30	1 50					.
Protein Meal "A"	127	WESFARMERS	Westralian Farmers Co-op., Ltd.	Meat meal, salt, manganese, butter milk, maize meal, fish meal, ground limestone	35 00	10·00	4·00	2 00	..	2 50	Manganese Trace	...
Protein Meal "B"	128	do.	do do. do.	Meat meal, liver meal (when available). bone meal, fish meal, ground limestone	35 00	10 00	4·50	.	..	5·00	.	....
2.—Cattle Foods.												
Sweet Dairy Food	10	THOMAS .	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, wheaten meals, wheat germ, salt, ground limestone, malt combings, and/or gristed linseed (bone meal if available), milk powder, molasses	11·50	(Min.) 1·50	8 50	1·75	...	4·00	..	..

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis. Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5)	Lime.	Other.	
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	%	% Ca	%	%
Sweet Cow Food . .	11	THOMAS ...	W. Thomas & Co. (W A.), Ltd.	Bran, wheaten meal, mill screenings, malt combings, and/or gristed linseed, molasses, salt ground limestone	9·00	1·50	15·00	1 50	. ..	4·00	. ..	....
Mormilk No. 2	32	PANNIFEX ..	Wrights, Ltd.	Flax, linseed, bols refuse, wheat polishings, oat pollard, rape seed meal, rice meal, meat and bone meal, bone meal	20·00	4·75	14·00	Trace	Trace	Trace	....	....
Milk Food	62	WESTERN ..	David Gray & Co Pty., Ltd.	Linseed meal, peanut meal, yeast, bone meal, oat meal, limestone	22·50	7·00	5·00	.	...	0·50	..	....
Sweet Dairy Food	64	do. ..	do. do. do.	Malt combings, yeast, oat meal, wheat meal, mill offal, limestone, linseed, salt	12 00	3·00	10·00	..	....	0·50	....	....
Cattle Food ...	99	EVELYN	Tropical Traders, Ltd. ..	Linseed (whole and meal), pollard, salt, limestone, chalk, molasses, sulphur, medicinal herbs, minerals	6·50	5·40	14·00	6·00	5·50	6·00	(Max.) Sulphur 3·50	....
Cow Food ..	103	DAISY FOOD	Barrow, Linton & Co.	Wheat, oats, barley, pea meal	9·00	2·50	4·00	...	.	. ..		....
Sweetened Dairy Meal	131	WESFARMERS	Westralian Farmers Co-op., Ltd.	Wheat meal, bran, oat meal, linseed meal, clover, pollard, molasses, bone meal, ground limestone, salt, bluestone	11·00	2·50	6·00	1·00	.. .	0·70	Cu. ·003	....
3.—Calf Foods.												
Calf Milk	20	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Butter milk powder, maize meal, pollard, salt, ground limestone	13·50	2·50	6·00	1·25	..	10·00	...	.
Calf Food ...	21	do. .	do. do. do.	Linseed meal, pollard, and/or maize meal, salt, ground limestone	15 50	2·50	6·50	3·00	.	15·00	....	..
Do.	30	PARSONS	Parsons Bros. & Co. Pty., Ltd.	Wheat, oat brannings, linseed, limestone. salt	12·00	2·00	6·00	1·00	....	....	....	....
Do.	48	HARPERS STAR	R. Harper & Co., Ltd. ...	Oats, linseed, maize, barley, rice meal, condiments	11·50	12·00	7·00	....	...	....	....	...
Do.	63	WESTERN ...	David Gray & Co. Pty., Ltd.	Linseed meal, oat meal, peanut meal, powdered milk, yeast, bone meals, minerals	22·50	7·00	5·00	.. .	2·00	0·50	....	....
Kaf-o-vite	83	KAF-O-VITE ..	Goldsbrough Mort & Co. Ltd.	Rice meal, barley meal, wheat, pollard, linseed meal, bone charcoal, limestone, cane sugar, essence of aniseed	16·50	10·50	7·50	....	0·80	1·50	....	....

Calf Food	97	EVELYN	Tropical Traders, Ltd....	Wheat, pollard, linseed whole, salt, sugar, chalk, medicinal herbs, minerals	10·50	4·77	3·86	3·00	....	0·75	....	....
Do.	112	VETAMAC .	A. H. McDonald & Co.	Wheat, pollard, maize meal, linseed meal, milk, sugar mutton bird oil	15.35	7.50	1.50	..	....	....	....	..
Calf Meal ..	132	WESFARMERS	Westralian Farmers Co-op., Ltd.	(Wheat, maize and barley meals), bran, butter milk, whey powder, linseed meal, ground limestone, bone meal, salt, copper sulphate	13.00	3 50	6.00	Less than 1.00	.	0.50	..	..
4.—*Sheep Foods.*												
Maintenance Sheep Nuts	65	WESTERN .	David Gray & Co. Pty., Ltd.	Linseed meal, yeast meal, limestone, bone meal, salt, minerals	15.00	3.00	7.00	..	..	0.50	.	....
Ewe and Lamb Nuts	66	do.	do. do. do.	Linseed meal, yeast meal, bone meal, malt, wheat germ, bone meal, salt, minerals	22 50	7.00	5.00	..	.	0.50		....
Sheep Food	100	EVELYN .	Tropical Traders, Ltd.	Linseed (meal and whole), pollard, salt, limestone, chalk, sulphur, medicinal herbs, minerals	6 50	5 90	14 80	6.00	4.00	7.25	(Max.) Sulphur 3.80	..
Sheep Maintenance Cubes	135	WESFARMERS	Westralian Farmers Co-op., Ltd.	(Oat, wheat, barley, linseed, peanut, and cocoanut meals), clover, pollard, bone meal, molasses, salt ground limestone and minerals.	14.00	3.00	7.50	Less than 1.00	..	0.70	.	..
Sheep Breeder Cubes	136	do.	do. do. do.	Same as above.	13 00	3.00	7.50	0 50	.	0 70	.	..
5.—*Poultry Foods.*												
Special Laying Mash	2	THOMAS	W. Thomas & Co (W A.), Ltd.	Bran, pollard, wheaten meal, and/or oat meal, liver meal, salt, ground limestone	13 50	3 00	7 50	1 50		3 75	.	.
Laying Mash No. 1	3	do.	do. do. do.	Bran, pollard, wheaten meal, and/or oat meal, wheat germ, meat meal, milk powder, yeast, salt, ground limestone	14.00	2 50	6.00	1 50	.	3.75		..
Laying Mash No. 2	4	do.	do. do. do.	Bran, pollard, wheaten meal, and/or oaten meal, wheat germ, bone meal, pea meal, and/or milk powder, salt, ground limestone	11.00	2 50	6.50	1 50	.	3.75	.	.
Fattening Mash .	5	do.	do. do. do.	Bran, pollard, wheaten meals, and/or oat meal, wheat germ, maize meal, milk powder, salt, limestone	10.00	2.00	6.50	1.25	.	3.75	..	..
Poultry Mash ...	28	K.B. .. .	C. A. Kirkby & Sons	Wheat, bone, salt, bran, pollard, riboflavin, cocoanut meal	13.00	3.45	7.00	1.00	1.21	2.00	..	..

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made	Registered Analysis. Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5)	Lime.	Others.	
					% (Min.)	% (Min.)	% (Max.)	% (Max.)	%	% Ca.	%	%
Eggmilk	17	THOMAS ..	W. Thomas & Co. (W.A.), Ltd.	Butter milk powder, milk powder, pollard, salt ground limestone	15 00	5.00	4.00	3 00		15 00		.
A1 Laying Mash	58	WESTERN	David Gray & Co. Pty., Ltd.	Bran. pollard, wheat meal, meat meal, bone meal, linseed meal, yeast, limestone	14.00	3 00	5 00	2 00		0 50		
Laying Mash "B"	59	do.	do. do do.	Same as (58) less meat meal	12 50	3 00	5 00	2 00		0 50		
Laying Mash No. 1	69	MILLERS	W. H. Milne & Co.	Bran, pollard, wheat meal, gristed oats, meat meal, bone meal, limestone, salt	14 00	4.00	5.50	1 50	2 00	3 00		
Laying Mash	73	MORLAY	R. B. Young	Wheat meal, bran pollard, meat meal, bone meal, limestone, minerals	14 00	3 00	5.50	1 50	3.50	2.50		
Growing Mash	74	do.	do. do.	Same as (73) plus milk powder when available	12 50	3 0	5 50	1 50	4.00	2 50		
Laying Allmash	75	do.	do. do.	Same ingredients as (73)	13 00	3 00	6.00	1.5	4.00	2.50		
Growing Allmash	76	do.	do. do.	Same as (75) plus ribon	12 00	3 00	6.00	1.5	4.00	2 50		
Laying Mash "B"	79	do.	do. do.	Wheat meal, bran, pollard, bone meal, limestone, minerals	11 50	3 00	6 00	1 5	4.00	2.00		
"D" Mash (Fattening)	80	do.	do. do.	Wheat meal, bran, pollard, bone meal, minerals	10.50	3.00	5.00	1 50	3 50	2.00		
Fattening Mash	106	DUKKO	Barrow, Linton & Co.	Bran, pollard, wheat meal, oat pollard, bone meal, salt, limestone	10.00	4 00	4.00	1.00	..	3.00		
Laying Mash	107	EGGLAYER .	do. do. do	Same as (106) plus meat meal, and less bone meal	14.00	3.50	4.50	1.00	.	3.00	.	.
Growing Mash .	108	GROWELL	do. do. do.	Same as (107) plus wheat germ	14.00	4 50	4.50	1.00		3.00		
Growers Mash .	119	WESFARMERS	Westralian Farmers Co-op., Ltd.	Meat meal, wheat meal, pollard, oat meal, bran, butter milk, salt, limestone	13.00	4.00	7.50	0 50		0.70	.	.
Laying Mash No. 1	120	do.	do. do do.	Same as (119) plus whey powder	14 00	4.00	7.00	0.50	.	1.00	..	.
Laying Mash No. 2	121	do.	do. do. do.	Same as (120) less meat meal	11 00	3.00	7.00	0 50	..	0.80		.
Growers Pellets .	124	RED COMB	do. do. do.	Same as (119) plus fish meal when available	13 00	4.00	7.50	0.50		0.70		
Laying Pellets No. 1	125	do.	do. do. do.	Same as (120) plus fish meal when available	14.00	4.00	7.00	0.50		0.80		....
Laying Pellets No. 2	126	do.	do. do. do.	Same as (121)	11.00	3.00	7.00	0.50		0.80	...	....
Poultry Fattening Mash	129	WESFARMERS	do. do. do.	Barley meal, wheat meal, pollard, oat meal, bran, butter milk, fish meal, salt, ground limestone	10.00	2.50	6.00	0.50	.	0.70	...	...
Poultry Fattening Pellets	130	RED COMB	do. do. do.	Same as (129) . .	10 00	2.50	6.00	....	..	0.70	..	....

6.—Chick Foods.												
Chick Starter	6	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, wheaten and/or oaten meal, wheat germ, meat meal, milk powder, maize meal, lucerne pollard, crayfish meal, cod liver oil, salt, limestone	14.50	2.50	6.00	1.25		3.75	.	..
Chick Starter No. 2	7	do.	do. do. do.	Same as (6) less meat and crayfish meals	11 00	1.50	6.00	1.25	...	3.75	.	..
Chickgrower ..	8	do.	do. do. do.	Same as (6) less cod liver oil and crayfish meal	13.50	2.50	6.00	1.25	.	3.75		..
Chickgrower No. 2	9	do.	do. do. do.	Same as (8) less meat meal	11.00	1.50	6.00	1.25		3.75	..	.
Chickengrain	14	do.	do. do. do.	Maize, wheat, peas, shellgrit, kalo corn	9.00	1.50	4.50	.	...	.	..	.
Chicken Milk No. 1	18	do.	do. do. do.	Milk powder, meat meal, liver meal, fish meal, bone meal, pollard, salt, limestone	20.50	1.50	4.00	3.00	....	15.00	..	..
Chicken Milk No. 2	19	do.	do. do. do.	Butter milk powder, bone meal, pollard, salt, limestone	18.00	1 50	4.00	3.00	.	15.00	..	..
Chickfood .	27	W.A.P. APEX	W.A. Produce Co.	Wheat, maize, peas, oats, grit	10 00	3 00	6 50	.			.	..
Do. .	49	H & C	Haynes & Clements	Wheat, maize, peas, grit, kalo corn	9 00	1.50	4.50		....	3.00	.	...
Chickstarter ...	145	WESTERN .	David Gray & Co. Pty., Ltd.	Pollard, bran, maize meal, meat meal, wheat meal, yeast, wheat germ butter milk, bone meal, cod liver oil	14 50	4 00	4 50		2.00	0.50	.	.
Chickbuilder	57	do.	do. do. do.	Same as (145) less wheat meal	14 00	4 00	4 50		2.00	0.50	.	..
Do.	67	MILLER	W. H. Milne & Co. .	Bran, pollard, wheat meal, cod liver oil, maize meal, gristed oats, salt, whey powder, oyster flour	15 00	4.00	5 50	12·50	2 00	2.50		....
Chickstarter .	68	do.	do. do. do.	Same as (67), except oat meal in place of gristed oats	15 00	4.00	5.50	1.00	2.00	2.50	.	.
Do.	77	MORLAY	R. B. Young	Wheat meal, bran, maize meal, meat meal, milk powder, bone meal vitaminised oil, gristed oyster shell grit, minerals	15 00	3 00	5.50	1 50	3 50	2.50	.	...
Chick Allmash	78	do.	do.	Same as (77), except ribon in place of vitimanised oil	12 50	3 00	5.50	1 50	3 50	2.00	.	
Chickstarter . .	104	VITALIZER	Barrow, Linton & Co.	Bran, pollard, wheat meal, oat pollard, wheat germ, meat meal, milk powder, salt, gristed limestone, oil	15 00	4 00	4.50	1 00		3.00	.	.
Chick Grain .	105	CHIC CHIC	do. do. do.	Wheat, oats, maize, peas	9.00	2 70	5.00			.		
Chicken Mash ..	116	ROYAL SEAL	J. & W. Bateman	Pollard, bran, maize meal, oat meal, powdered milk, bone meal, meat meal	10 00	2 00	4 00			.		..
Chicken Meal	115	do.	do. do.	Wheat, pannicum seed, peas, maize, shell grit	10 00	2 00	4.00	..				.
Chick Mash "A"	117	WESFARMERS	Westralian Farmers Co-op., Ltd.	Meat meal, liver meal, maize meal, ground limestone, salt, wheat meal, oaten meal, bran, pollard, butter milk, manganese sulphate, vitaminised fish oil	15.00	4.00	7.00	Trace		0 30		.

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.							
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5)	Lime.	Other.	
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% Ca.	%	%
Chick Mash " B "	118	WESFARMERS	Westralian Farmers Co-op., Ltd	Meat meal, ground limestone, vitaminised fish oil, wheat meal, oaten meal, pollard, bran, butter milk, salt	14 00	4 00	7.00	0.50	.	0.50	.	....
Chick Pellets " A "	122	RED COMB	do. do. do.	Same as (117)	15.00	4 00	7.00	Trace	..	0.30	.	....
Chick Pellets " B "	123	do.	do. do. do.	Same as (118)	14.00	4.00	7.00	0.50	.	0.50	.	...
7.—*Pig Foods.*												
Pig Starter	12	THOMAS ..	W. Thomas & Co. (W.A.), Ltd.	Pollards, pea meal, meat meal, wheaten meal, salt, gristed limestone	13 00	1.50	6.00	1.25	..	3 75	(Max.) Sulphur	..
Pig Grower	13	do.	do. do. do.	Pollard, wheat meal, bone meal, milk powder, salt, ground limestone	12.00	1.50	6 00	1.25	...	3 75	.	...
Pig Food	98	EVELYN .	Tropical Traders, Ltd. .	Pollard, linseed (meal and whole), limestone, chalk, sulphur, minerals, and medicinal herbs	8 00	10.50	12.35	3.00	4.40	6.80	3.80	..
8.—*Horse Foods.*												
Sweet Horse Foods	15	THOMAS ..	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, wheaten chaff, molasses, salt, ground limestone	6.00	1.50	25.00	1.50	....	3.75	...	...
Horse Food	96	EVELYN	Tropical Traders, Ltd. ...	Pollard, linseed meal, linseed (whole), wheat, salt, chalk, sulphur, other minerals, and medicinal herbs	12.60	5.70	7.14	6.00	0.90	1.10	1.84	..
9.—*Dog Foods.*												
Dog Biscuits	38	BOANS LOCAL	A. E. Robinson	Wheat, bone, meat, vegetables	15.00	4.00	3.00	...	2.50	2.50	....	..
Charcoal Shapes	39	SNAPS	do. do. .	Same as (38) plus charcoal ..	14.00	3.00	6.00	....	2.50	2.50	.	....
Puppy Meal	40	do.	do. do.	Wheat, bone, meat, vegetables	15.00	4.00	2.00	...	3.50	4.00	..	....
Plain Shapes	41	do.	do. do. .	do. do. do.	15.00	4.00	2.00	...	3.50	1.50	...	..
Puppy Biscuits	42	do. .	do. do.	do. do. do.	15 00	4.00	2.00	...	3.50	4.00	..	...
No. 1 Dog Biscuits	43	do.	do. do.	do. do. do.	15.00	4.00	2.00	.	3.50	4.00	...	....
C.—STOCK LICKS. 1.—*Mixed Stock Licks.*												
Di-Calcic Phosphate	34	C.S.M.L. ..	Cuming Smith & Mt. Lyell F.F., Ltd.	Calcium phosphate at least 90% of the P_2O_5 being as Di-Calcic-phosphate	....	....	....	...	(Min.) 37.00	CaO. 28.00	.	....
Denmark Lick Substitute	35	do. ..	do. do. do.	Limonite, sulphate of copper, salt	....	....	....	38.00	....	....	(Min.) FE 20.00	(Min.) Cu 0.14

Di-Calcic Lick	36	do. .	do. do. do.	Di-calcic, phosphate, salt, molasses		...	.	38.00	18.00	13.00	....	....
Copper Lick	37	do.	do. do. do.	Di-calcic phosphate, copper sulphate, salt				66.00	12.50		Cu 0.10	....
Cobaltised and Copperised Sheep Lick Concentrated "D"	84	VITA LICK ...	Goldsbrough, Mort & Co., Ltd.	Bone flour, bone charcoal, sod-sulphate, sulphur, limonite, pot. iodide, copper sulphate, cobalt chloride, rice meal, cocoa meal wheat meal	. .				23.50	30.00	Iron 1.30	Sulphur 2.00
Cobaltised and Copperised Sheep Lick Concentrated "G"	85	do.	do. do. do.	Same as (84) .	. .				23.50	31.00	3.52	4.00
Cobaltised and Copperised Sheep Lick Mixed "G"	86	do.	do. do. do.	Same as (84) plus molasses				80 00	3.80	4.90	0.56	0.64
Cobaltised and Copperised Sheep Lick Mixed "D"	87	do. . .	do. do. do.	do. do. do.				80 00	3.70	4.70	0.18	0.32
Cobaltised and Copperised Cattle Concentrated "D"	88	do. . . .	do. do. do.	Same as (84) less limonite	.		....	Nil	21.70	29.00	3.40	0.40
Cobaltised and Copperised Cattle Concentrated "G"	89	do.	do. do. do.	do. do. do.			. . .	Nil	25.00	32.50	4.70	1.15
Cobaltised and Copperised Cattle Mixed "D"	90	do. .	do. do. do.	Same as (84) less limonite and plus molasses	.	.	. . .	75 00	4.20	5.40	0.64	0.08
Cobaltised and Copperised Cattle Mixed "G"	91	do.	do. do. do.	do. do. do.	. .	. .	...	75.00	4.40	5.80	0.88	0.22
Vitalick Mineral Mixture	92	V.M.M. ..	do. do. do.	Bone flour, bone charcoal, spanish iron oxide, ferrous sulphate, flowers of sulphur, sodium sulphate, rice and cocoanut meals		....	....	4.30	9.50	12.50	0.47	1.40
Vitalick Mineral Blocks	93	VITALICK MINERAL BLOCK	do. do. do.	Carbonate of lime, sulphur, sulphate of iron, salt, iodide and cobalt chloride	. .		. . .	76 00		9.50	0.22	0.50
Chic-A-Vite	94	CHIC-A-VITE	do. do. do.	Same as (9) plus gentian, cod liver oil pot. iodide	..		. .	Nil	20 70	27.60	1.80	1.80
Por-co-vite	95	POR-CO-VITE	do. do. do.	Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, salt, limonite, limestone, copper sulphate, cobalt chloride, pot iodide, cod liver oil				13 00	19.10	30 00	0.62	9.70
Medicated Lick	113	VETAMAC	A. H McDonald & Co.	Salt, sulphate of iron, soda-bicarbonate, aloes, sulphur, wheat meal, molasses, other minerals				53.00	5.70	7.50	Iron 0.70	Sulphur 4.00
Mineral Concentrate	111	VETSOLICK	do. do. do.	Bone meal, pollard, sulphur, minerals					11 00	14.00	1.50	16.60
Di-calcic Lick	137	WESFARMERS	Westralian Farmers Co-op., Ltd.	Salt, di-calcic phosphate				60.00	15.00	11 00	.	.
Lime Lick . . .	138	do.	do. do. do.	Salt, calcium carbonate . . .		.		35.00	. .	$CaCO_3$ 40.00	....	. . .

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.							
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5)	Lime.	Other.	
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Min.)	%	% Iron (Min.)	% Copper (Min.)
Stock Lick ..	139	WESFARMERS	Westralian Farmers Co-op. Ltd.	Salt, bone meal, minerals		. .	.	80.00	0.85	15 00	0.17	0.12
Denmark Lick Substitute	140	do.	do. do. do.	Limonite, salt, copper sulphate	.	. .	. . .	65.00	. .	. .	10.00	0.15
2.—*Bone Meals.*										CaO		
Bone Flour .	24	CALPHOS . .	W. Thomas & Co. (W.A.), Ltd.	Bones	20.00		.	.	25.00	30.00	.	...
Bone Meal . .	26	WATTLE ...	Wattle Fertiliser Co.	do. . .	16.12		.		28.38	46.90	.	..
Do.	53	W.A.M.E.	W.A. Meat Export Works	do.	18 75		.	0.25	26.00	27.00	.	..
Sterilised Bone Flour	114	TRICALOS	Davis Gelatine (Aust.) Pty., Ltd.	do. . .	5.00			.	30.00	40.00	..	....
Bone Meal ..	142	ANCHO ..	Anchorage Butchers Pty., Ltd.	Waste meal product ...	23.63	2.44	Trace	. .	26.76	26.95	...	..
Sterilised Bone Grit Meal	143	N.A. .	W. Thomas & Co. (W.A.), Ltd.	Bones . .	20.00		.	.	15.00	20.00	. .	....
Bone Meal	144	THOMAS .	do. do. do.	do.	10.00	.		...	20.00	25.00	.	....

ANALYSES OF FEEDING STUFFS.

RESULTS of Analyses of samples of Feeding Stuffs taken under the Feeding Stuffs Act, 1928-1946.

(Published under section 9 of the Act.)

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime.	Others.	
		%	%	%	%	%	%	%	%
	Barrow Linton & Co.								
	" Chic Chic " Chick Grain—								
	Reg. Analysis	†9.0	†2.7	*5.0					
10-6-48	Sample Analysis	13 7	1.8	2.5					
	" Egglayer " Laying Mash—						$CaCO_3$		
	Reg. Analysis	†14 0	†3.5	*4 5	1 0		3 0		
30-4-48	Sample Analysis	18 1	4.6	4.4	0.50		2.33		
	" Excelsior " Meat and Bone Meal—								
	Reg. Analysis	†40.0	*15.0	*1.5					
30-4-48	Sample Analysis	39.9	10.0	0.5					
	" Vitalizer " Chickstarter—								
	Reg. Analysis	†15.0	†4.0	*4 5	1 0		3.0		
1-6-48	Sample Analysis	20.9	5.2	4 5	0.96		2.49		
	" Daisy Food " Cow Food—								
	Reg. Analysis	†9.0	†2.5	*4 0					
10-6-48	Sample Analysis	15.8	5.4	6.7					
	J. & W. Bateman, Ltd.								
	" Patriot " Chick Food—								
	Reg. Analysis	†11 8	†3.0	*3.8					
9-6-48	Sample Analysis	10 2	2 1	2.9					
	David Gray & Co., Ltd.								
	" Western " Chickbuilder—								
	Reg. Analysis	†13 5	†2 5	*4.5			1 5		
20-5-48	Sample Analysis	13 4	4.0	3.9			0.27		
	" Western " Chickstarter—								
	Reg. Analysis	†14.5	†3.0	*4.5			1.5		
25 5-48	Sample Analysis	13.7	5.3	4 6			0 4		
	" Western " Fattening Mash—								
	Reg. Analysis	†11 0	†3.0	*5 0	0 5		1 5		
3-6-48	Sample Analysis	12 2	2.4	4 7	0 17		0.58		
	"Western" Laying Mash "B"—								
	Reg Analysis	†11.0	†3 0	*7 0	0 5		1 5		
2-6 48	Sample Analysis	12.6	2.3	4.4	0 16		0.26		
	Goldsbrough, Mort & Co., Ltd								
	" Vita Lick " Cobaltised and Copperised Cattle Lick Concentrated " G "—						CaO	Iron.	Sulph.
	Reg. Analysis				*Nil less than	†25 0	†32 5	†4 7	†1 15
9-6-48	Sample Analysis				0 01	24 5	33 0	4 9	1 56
	" Vita Lick " Cobaltised and Copperised Sheep Lick Mixed " D "—								
	Reg. Analysis			....	*80.0	†3.7	†4.7	†0 18	†0.32
9-6-48	Sample Analysis	..		..	77.8	3.6	5.2	0.50	0.10
	Kraft Walker Cheese Co. Pty., Ltd.								
	" Krafco" Dried Whey Powder—							Lactose	
	Reg. Analysis ...	†10·0	†0·5		...	1·0	0·7	68·0	...
19-5-48	Sample Analysis ...	12·4	0·5		....	1·42	0·98	67·3	...
	W. H. Milne & Co.								
	" Millers " Chickbuilder—						CaO		
	Reg. Analysis	†16.00	†4.72	*3.4	1.16	2 04	2.21		
26-5-48	Sample Analysis	14.8	5.4	4.5	1.0	1.70	2 4		..
	" Millers " Chickstarter—								
	Reg. Analysis	†15.06	†4.34	*6.10	1.09	1.84	3.11	..	
26-5-48	Sample Analysis	14.6	8.0	4.7	0.4	1.47	1.8		
	Sims Cooper (Freezing Works) Pty. Ltd.								
	" Champion " Meat Meal—								
	Reg. Analysis ...	†50.0	*12.0	*5.0	...	..		...	
1-6-48	Sample Analysis	52.3	11.4	1.1	..			..	..

* Maximum † Minimum.

ANALYSES OF FEEDING STUFFS—continued.

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid P_2O_5.	Lime.	Others.	
		%	%	%	%	%	%	%	%
	State Abattoirs.								
	"State Abattoirs" Midland Meat Meal—								
	Reg. Analysis	†51.0	14.0	*2.0	.		.	....	. .
27-5-48	Sample Analysis	49.0	26.9	2.7	. .		.	. .	. . .
	W. Thomas & Co. (W.A.). Ltd.								
	"Thomas" Laying Mash No. 1—						Ca		
	Reg. Analysis	†14.0	†2.5	*6.0	1.5	.	3.75	. . .	....
2-6-48	Sample Analysis	15·4	3·9	4·5	1·49	....	2·15	....	....
	"Thomas" Quicklay—								
	Reg. Analysis	†35.0	*15.0	*4.0	*3.0	.	*15.0	. . .	....
26-5-48	Sample Analysis	39 7	15.5	1.6	1.8		13.9	. .	....
	"Thomas" Sweet Dairy Food—								
	Reg. Analysis	†11.5	†1.5	*8.5	1.75	.	4.0	....	....
2-6-48	Sample Analysis	12.7	2.7	6.7	1.86	.	2.10	....	. . .
	Wattle Fertiliser Co.								
	"Wattle" Bone Meal—								
	Reg. Analysis	†16.12	†3.5	*5.01	.	28.38	46 9	..	....
16-6-48	Sample Analysis	25.6	6.0	1.7	.	22.8	30 1	...	.
	Westralian Farmers Co-op., Ltd.								
	"Wesfarmers" Laying Mash No. 1—						$CaCO_3$		
	Reg. Analysis	†14.0	†4 0	*7.0	0.5		2.5	....	. . .
24-5-48	Sample Analysis	13.4	5.0	3.7	0 7		3.2	....	
	"Wesfarmers" Laying Mash No. 2—								
	Reg. Analysis	†11 0	†3.0	*7.0	0.5		2 5	....	..
27-5-48	Sample Analysis	10.9	2.6	4.5	0.6		2 4	. .	. .
	"Wesfarmers" Protein Meal "B"—								
	Reg. Analysis	†35.0	†7.0	*4.5				15.0	.
25-5-48	Sample Analysis	36.0	8.4	1 5			. .	14 9	.
	"N-A." Sterilized Bone Grit Meal—								
	Reg. Analysis	†20.0	*10 0	*1.0				. .	
3-6-48	Sample Analysis	20.1	8.5	1.9			.	...	....
	Wright's, Ltd.								
	"Wrights" Meat Meal—								
	Reg. Analysis	†40.0	*11.0	*1.5		14.2			
1-6-48	Sample Analysis	44.9	7.6	0.5	.	14.0		.	
	Robert. B. Young.								
	"Morlay" Chick Allmash—						CaO		
	Reg. Analysis	†14.0	†3 0	*6.0	1 0	2.0	5.0	. . .	
20-5-48	Sample Analysis	15 9	4.0	3 0	0.74	2.56	3 03	.	.
	"Morlay" Fattening Mash "D"—								
	Reg. Analysis	†11.0	†4 0	*6 0	1 0	3 0	5.0		
20-5-48	Sample Analysis	14.2	3.2	3 8	0 25	2 64	4.05		

* Maximum. † Minimum.

By Authority: WILLIAM H. WYATT, Government Printer, Perth.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA

Vol. 25. (Second Series) DECEMBER, 1948 No. 4

THE CULLING OF POULTRY FOR EGG PRODUCTION.

By R. H. MORRIS, Agricultural Adviser.

THE ability and willingness to cull has been and will always be of prime importance as a necessary requirement of the successful poultry farmer. Today more so than ever, high cost of production together with shortages of building materials, and many of the more important poultry feeding-stuffs demand that the poultry farmer's energies and feeding-stuffs be directed to the production of eggs from profitable hens only. He cannot hope to do this if he is reluctant to rigorously cull his flock. Having the ability to cull is of little use if he is not prepared to cull frequently and to immediately dispose of those individuals that he knows to have become unprofitable. The successful poultry farmer is the man who watches his flock daily, ever on the lookout for birds that have "broken down," become diseased, developed vicious habits, or in the case of growing chicks, those that lag behind the rest of the flock in their development. These are a few of the signs which label the "cull" bird. When he sees these profit-consuming individuals, he is quick to destroy or market them, as he realises the danger they are to the financial wellbeing of his family and himself. Such a man is ruled by his head, not by his heart, with the result that he does not keep his fowls– his fowls keep him.

Single pen testing and trap nesting of hens give an accurate record of a fowl's annual egg production. These methods of testing are, however, not available to the majority of poultry farmers, and as it has been found by research workers and poultrymen the world over that certain body features can be closely correlated with high or low egg production, it is proposed in this article to outline these features and so describe the "good" and the "bad" points which we look for in selecting and discarding hens for egg production. This method is known as the "observation and handling method." Body features are of the greatest importance in separating the very high producers from the very low producers. Also these body features when noted at intervals during the year tell fairly accurately of the fowl's past performance. In this way we are given a guide as to her probable future performance, as a bird

which has performed well in the past is most likely to perform well in the future. Culling should not be applied to laying hens only, but also to hatching eggs, chicks, pullets, cockerels and breeding males.

Unfortunately, no system of culling is infallible, even expert cullers being likely to reject a few good birds and retain a few poor ones when examining a laying flock, but the numbers that are likely to be misjudged are so few that this factor need not be taken into consideration.

As mentioned previously, the culling of poultry involves the recognition and disposal of birds, which show themselves to be unprofitable. These unprofitable birds may be the result of an inferior genetic makeup which does not fit them for high or even medium egg production or the result of mismanagement on the part of the flock attendant. The most common examples of mismanagement are:—Improper feeding (including watering) and housing of the birds, and allowing the birds to become diseased. This latter example may or may not be the result of the farmer's neglect.

Before attempting to cull a flock its history should therefore be known. The history embraces information relating to the quality and type of stock, month of year when chickens were hatched, length of time the birds have been in production, diseases suffered by the birds, the management and feeding of the birds, type of housing, and incidence of broodiness.

The time of the year in which chickens are hatched is particularly important and producers will find that they are amply repaid for any effort they might make to secure their chicks at the optimum time of the year. It has been proved conclusively that it pays to hatch chickens during the months of July, August and September in Western Australia. A late hatched chicken will not develop as well as a chick hatched in season and will often take nine months to come into production. Such a pullet will lay well during September and October when egg prices are at their lowest, and poorly during the high price period. On the other hand, with the very early hatched chicken (May-June) there is a real danger of the pullet going into a neck moult shortly after commencing production with consequent loss of production at a time (February, March, April) when the farmer is in need of all the eggs this bird can possibly produce.

The months recommended for hatching chickens in Western Australia are:—Heavy breed chicks, July-August; light breed chicks, August-mid September. Because of the varying climates found between Geraldton and the extreme south of the State, the following table (See page 313) has been included to guide Western Australian producers as to the time of the year they should take delivery of day-old chicks. Local climatic conditions must be taken into consideration when deciding on the best time to procure chickens; because of this no hard and fast time can be allocated to any one district.

Unless otherwise stated, remarks made about the various classes of stock in this article refer to chickens hatched in season for the metropolitan area, and which would be expected to commence laying in March.

When first gaining experience in culling, the farmer should place hens he thinks to be "culls" in a pen by themselves, and their egg production over one or two weeks should be recorded. In this way the farmer will gain confidence in himself. Having once gained this confidence he is more likely to set about the job of culling with an easy mind and be drastic in his decisions should circumstances warrant it. At certain times of the year one feature in itself (e.g. the

early moulting hen) is sufficient evidence on which to cull a bird. At other times of the year several body features must be taken into consideration before a bird is discarded.

PURCHASING TIMES FOR CHICKENS.

District.	Optimum Week.		Range.
	Heavy Breeds.	Light Breeds.	
Geraldton and Eastern Wheat Belt:—			
Narembeen, Wyalkatchem, Dowerin, Merredin, Corrigin	2nd week July	4th week July	3 weeks.
Northam-Katanning	3rd week July	1st week August	5 weeks.
Metropolitan	1st week August	3rd week August	5 weeks.
Waroona	1st week August	1st week September	5 weeks.
Bunbury	3rd week August	2nd week September	5 weeks.
Southern Coastal Band:—			
Busselton, Mt. Barker, Pemberton, Albany	1st week September	3rd week September	3 weeks.

The question is often asked. "How many years does it pay to keep fowls?" or "Someone told me to dispose of my hens after they have finished their second year's lay. Is this correct?" No, it is not correct. When determining the worth of a flock we must examine each individual bird in that flock and immediately a bird shows signs of becoming unprofitable, it must be discarded. The practice of holding hens until they reach a certain age or until the production of a pen of birds falls to a certain level and then discarding them "en masse," irrespective of the individual merits of each bird in the pen, is not a sound one. In reply to the first question, experience has shown that the most economical flock to keep for egg production is one which carries approximately two laying pullets to every one or one-and-a-half adult hens, an adult hen being regarded as a two, three or four year old hen.

When attempting to increase the average egg laying capacity of an inferior flock the 2 : 1 ratio should be used. Having once obtained a satisfactory lay of approximately 180 eggs per bird per year the use of a 2 : 1½ ratio should be economically sound, when the flock average falls below this figure however, the necessity for more drastic culling of the birds is indicated.

Figures issued by the Government Statistician, covering the number of pullets and old hens (one year and over) which constitute a portion of the poultry population of Western Australia show how unbalanced the poultry industry is in this State. Statistics for 1946 show that in March of that year (a month in which the maximum number of potential layers would be carried on a commercial farm and a month in which all old hens should have been culled) there were more old hens than pullets (hatched 1945) being carried by the industry. That this unfavourable balance is shown not only by Statewide figures but by figures gathered from nearly all of our generally recognised "poultry districts" is a tragedy and obviously one of the most important single factors which is retarding the progress of the industry today.

To illustrate the importance of culling hens of laying age it is interesting to compare returns (value of eggs less rearing and feeding costs) which we could expect to receive from a culled and unculled flock respectively.

Let us first consider the unculled flock. The expenditure on, and return per bird from such a flock could easily be as follows:—

	Per Bird.
Chicks at £8 per 100 allowing 20 per cent. loss	1 11
Brooding	3
Feeding to 24 week old stage	2 6
Total expenses to date	4 8
Eggs laid first 12 months, average 12 dozen per bird (@ 1s. 7d. per dozen)	19 0
Feed cost during the 12 months laying period	10 0
Profit	9 0
Less rearing costs	4 8
Net profit per bird end of first year	4 4
Second year laying 75 per cent. of first year = nine dozen (@ 1s. 7d.)	14 3
Cost of feeding second 12 months	10 0
Net profit	4 3

Under such management the second year birds return the same profit (approximately) as the birds in their first year of lay, and if we were content with this small profit there would be little advantage in carrying twice as many pullets as we have hens. BUT are we content with this small profit? Let us now examine the return we would expect from a well culled flock.

	Per Bird.
Rearing costs	4 8
Eggs laid first 12 months, 15 dozen (@ 1s. 7d. per dozen)	23 9
Feed costs during 12 months laying period	10 0
Profit	13 9
Less rearing costs	4 8
Net profit	9 1

By drastically culling one half of the pullet flock, the remaining birds in the second years lay should equal the average lay of the first year flock:—

Fifteen dozen @ 1s. 7d. per dozen	23 9
Food cost during second 12 months	10 0
Profit	13 9

The average profit per bird from a culled flock such as this which carries two pullets to every adult hen is 11s. 5d., as compared with 4s. 3½d. for the unculled flock. The general health of the culled flock would be far superior to that of the unculled flock and the mortality rate would be much lower.

Should a pullet flock which averages 15 dozen eggs per bird per year be left unculled it is reasonable to assume that the value of the eggs laid by each bird in her second year (75 per cent. production of first year) would be approximately 18s. instead of 23s. 9d. per bird for the culled flock. This means that a profit of 8s. per bird would be obtained from the unculled second year hens instead of the estimated 13s. 9d. for the culled second year hens—a difference of 5s. 9d. per bird per year or £287 10s. 0d. per 1,000 birds per year.

The rate of culling practised on the average farm should be approximately as follows:—

One thousand seven hundred day old chicks bought August-September.

One thousand three hundred and fifty pullets left after deaths (10 per cent.) and heavy culling to commence the first year production in March.

One thousand three hundred pullets left by July after culling out those that have gone into a neck or body moult thereby showing themselves to be unprofitable birds. Also to be culled would be those birds that after having laid for several weeks take a fortnight or three weeks rest. If birds of this latter type are not culled, these rest periods, and there will be many more during the year, will be of longer and longer duration as the year progresses. Of these 1,300 birds, approximately eight per cent. to ten per cent. will die during the first year and if they are heavy breed pullets (Australorps) 50 per cent. will be culled as they "break down" and/or become excessively fat and cease production from November to February inclusive, leaving approximately 550 birds to commence the second years production. It is usually not necessary to cull a White Leghorn flock of pullets as drastically as heavy breed pullets and of 1,300 White Leghorn pullets approximately 650 would be left to commence the second year's lay.

These 550-650 hens in their second year of lay would be culled during the laying season and particularly towards the close of the laying season. As a result of this culling, approximately 160 hens would be left to commence the third year's lay. The few that would warrant keeping over until the fourth year's laying season could well be used as breeding stock.

The most common features taken into consideration in culling hens for egg production are:—pigmentation changes, the capacity or body measurements shown by the birds, the moult, the appearance and texture of the comb, wattles and ear lobes, structure of the skull, and the disposition and temperament of the bird. It is proposed to treat these individual features before discussing the culling of growing chickens and the pullet flock. A short section on the selection of birds for the breeding pen has also been included.

Pigmentation Changes.—Yellow skinned breeds are so called because of the yellow pigment which they carry in their bodies, and which is most clearly seen in the skin around the vent, the eyelid, the earlobe, the beak and the shanks. This yellow pigment (xanthophyll) which is observed in these regions in a non-laying hen or pullet is the same pigment which gives the yellow colouration to egg yolks.

When fowls commence to lay there is a consequent deposition of the yellow pigment in the yolks, as a result of fecundity which deflects the normal path of secretion of the xanthophyll from the skin to the egg yolk.

The return of this pigment to the vent etc., is a measure of persistency, as this pigment begins to return to these regions immediately the bird ceases production and by noting the extent of pigmentation in these regions one can estimate the approximate time the hen or pullet has been in or out of production as the case may be. This is made possible by the fact that the pigment of the external parts disappears in a definite order at varying rates, and is regained by them in exactly the same order at which it is lost, only at a quicker rate.

The first region to lose the pigment when laying commences is the vent. This region will be devoid of pigment within a few days of the commencement of laying and is sometimes lost even before the first egg is dropped.

The pigment is then lost from the eyelid and earlobes in that order. Within one month or by the time 10 eggs (approximately) have been laid, the earlobes will have become bleached. The beak then loses its colour, bleaching begins at the corner of the mouth, or base of the beak, and gradually fades towards the tips. The arch of the mandible (top portion of beak) is the last part to lose the pigment. From five to eight weeks production or the laying of 25-50 eggs will usually see the elimination of all colour from the beak. Within three to five months the shanks will have lost their colour. The front of the shank loses its colour first and the back last, while the colour is retained longest just below the featherline at the rear of the hock joint. The shanks are the last region to regain the pigment when laying ceases.

The amount of pigment present in the birds depends on—

(i) The condition of the bird, (the fatter the bird the greater the amount of pigment present);

(ii) the type of food eaten by the bird.

Some foodstuffs are richer in xanthophyll than others. Yellow maize and green foods are rich in xanthophyll and will produce deeper coloured flesh than foodstuffs like bran, pollard, wheat and milk. Pigmentation observations should always be made in daylight, artificial light being unsatisfactory.

Because of the larger amount of fat present in the heavy breeds, light breeds usually bleach more rapidly than heavy breeds. The order of the most common breeds according to the rapidity with which the pigment fades is as follows:—Leghorns, Wyandottes, Plymouth Rocks and Rhode Island Reds.

It is difficult by the pigmentation test alone to distinguish between really good birds that have been laying continuously at a fast rate and those that have laid continuously at a slow rate. Both will have white shanks and in differentiating between these two classes of birds, use should be made of the capacity test.

A bird with a yellow vent, eyelid, earlobe, beak and legs has not been laying. The appearance of the comb and handling will indicate whether or not she is just beginning. A bird with a white vent but fully pigmented elsewhere has just begun or is about to lay.

A bird with yellow vent, eyelid and lobe, white beak and yellow legs has probably laid well for about two months but not long enough to bleach her shanks and has recently left off laying long enough to allow the pigment to return to the vent, eyelid and lobe but not long enough to return it to the beak.

A bird with white shanks, white tip of the beak but yellow vent, eyelid, lobe and base of the beak has laid well but is resting at the time of handling.

Because of an inhibiting factor which is present in the white skinned birds and dark shanked birds the yellow pigment cannot express itself in the external regions such as the vent, beak, etc. The pigmentation test, therefore, cannot be applied to a breed such as the Australorp.

Capacity.—Capacity is the term given to the distance between the rear end of the keel or breast bone and the two pelvic bones which lie slightly above, and to either side of the vent. For the sake of convenience this measurement is usually based on finger widths, and a fowl is said to have a small or a large capacity according to the number of fingers which when placed side by side can be fitted between the pelvic bones and the end of the breast bone. Capacity tells us whether or not a fowl is laying and also gives us an idea as to the rate of laying, or the number of eggs produced in a week.

Showing different features found in a high producing White Leghorn pullet (173 eggs, laid April-November, 244 days). Note well developed comb, deep body, broad flat back, and (page 318) the excellent capacity as shown by the backbone and breastbone being parallel to each other and four finger widths between the pelvic bones and rear end of the breastbone. Note also the good width (three fingers) between the two pelvic bones which in this bird are fine, flat and pliable.

See also page 317.

2. 3. 4.

A series of photographs (taken December) of an Australorp pullet which in the early part of her pullet year (April-November, 244 days) laid 215 eggs.

1. Note the shapely head, good deep body and broad back.

2. Clearly shows the parallel back and keel, which is most desirable in a good laying hen.

3. This picture illustrates an unusually large capacity of six finger widths, and at the time of handling she was laying 5-6 eggs per week.

4. A three finger pelvic span.

At the time of handling the pelvic bones were fine and pliable, showing her to be in good laying condition.

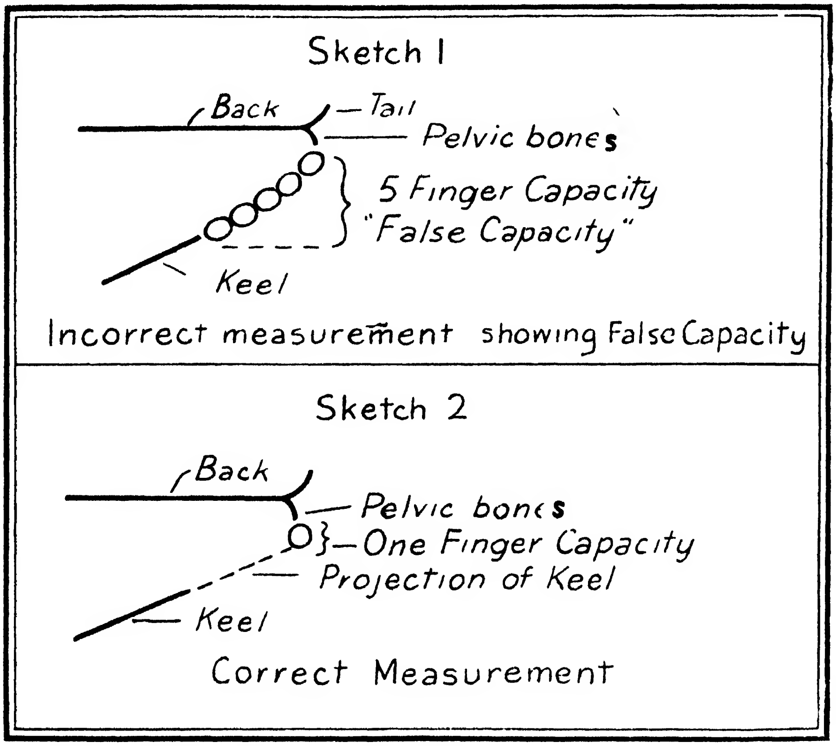
A fowl in production eats a large amount of food, and the digestive system is necessarily enlarged to cope with the increased food intake. The small intestine in particular is enlarged, as it is in this organ that most of the food is digested, and it is through the walls of the small intestine that most of the food nutrients are taken into the fowl's system. In addition the size of the ovary and oviduct of a high producing hen is many times as large as the same organs in a non-producing hen. The development of the digestive and reproductive systems in the manner described expands the abdominal muscles to their utmost, and the rear end of the breast bone is forced downwards to provide extra room for the enlarged organs. This results in the backbone and breastbone in a bird with excellent capacity being parallel to each other. Generally speaking the higher the rate of production the greater the capacity. The low producers or non-producing hens are "narrow behind" or wedge-shaped, they show little capacity. The methods used to determine capacity is to be seen in the accompanying photographs. (See pages 318, 319 and 341.) These photographs show the bird resting on the operator's left palm and forearm, with the left elbow close to the side of the body. The bird's two legs are firmly gripped by the fingers. Birds should be held in this manner, whenever they are handled, as in this position both the operator and the bird are comfortable.

The photographs also show the right hand placed in the correct position to measure capacity. The forefinger is rested alongside the pelvic bones, and the palm of the hand is kept at a right angle to the longitudinal axis of the fowl's body. The true capacity of the bird is the distance between the pelvic bones and the point where the projection of the breastbone strikes the right hand. The low producing hen very often has a short breastbone, and with such birds if the hand is pressed

1A. 2A.

1A. shows the reduced capacity of a non-laying white leghorn hen. But 2A. depicts a good four finger capacity, of an Australorp hen in production.

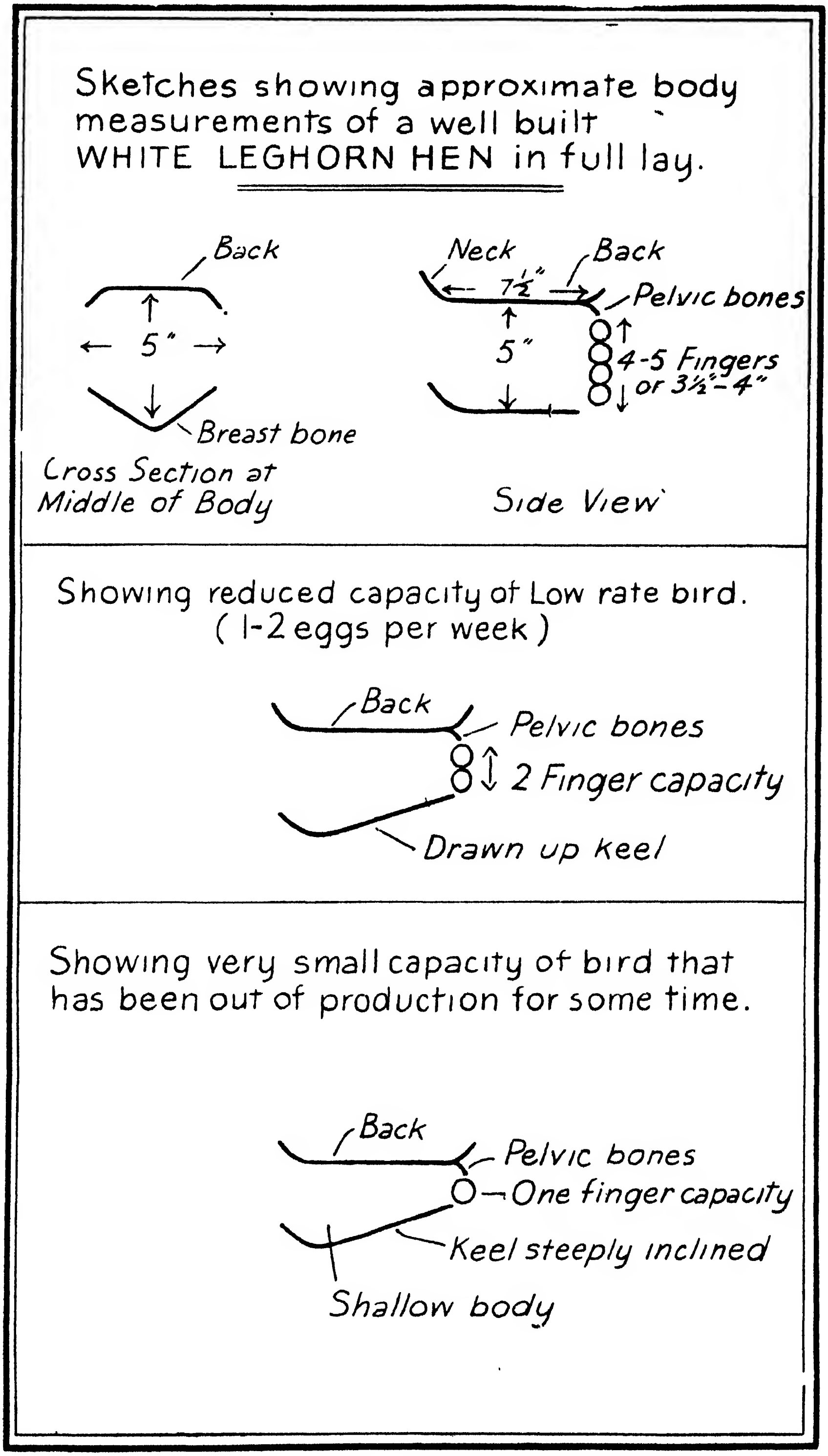
into the abdomen on an angle so as to be in a direct line with the pelvic bones, and the end of the breastbone, a "false" capacity is indicated (see sketches 1 and 2). It is because of this, that the projection of the breastbone referred to above and not the actual tip of the breastbone is always used in measuring capacity.



A fowl showing a high rate of production (five to six eggs per week) invariably shows good width between the two pelvic bones, finger measurements are used here also. The pelvic bones in the laying hen are flat sided, thin, pointed and pliable, and are fully extended at the time of maximum production. The pelvic bones in the non-laying hen are more or less rigid, close together and often have a thick covering of fat.

A hen that at the time of handling has a good capacity, i.e., four to five fingers between the pelvic bones and the breastbone and a good distance between the pelvic bones (three fingers) is usually laying several eggs in a week. Poor producers and non-laying birds will only have two to three fingers capacity and one to two fingers pelvic span. As production ceases the abdominal muscles having little to support. contract, and the bird's capacity decreases accordingly to two or three fingers. Heavy breed hens give slightly larger measurements than light breed hens.

As mentioned previously the good producer is invariably a ravenous eater. Sometimes however, the greater part of the food eaten over and above that required to maintain the weight of the bird is not directed towards egg manufacture but towards the production of fat. These fat birds are either low or non-producing birds and should be culled. They are identified by the presence of thick layers of


Sketches showing approximate body measurements of a well built WHITE LEGHORN HEN in full lay.
Back
5"
Breast bone
Cross Section at Middle of Body
Neck
Back
7½"
Pelvic bones
5"
4-5 Fingers or 3½"-4"
Side View
Showing reduced capacity of Low rate bird. (1-2 eggs per week)
Back
Pelvic bones
2 Finger capacity
Drawn up keel
Showing very small capacity of bird that has been out of production for some time.
Back
Pelvic bones
One finger capacity
Keel steeply inclined
Shallow body

hard, rubbery fat in the abdomen as distinct from the full, soft, pliable and expansive abdomen of the high rate hen. In addition the pelvics in the over fat hen will be close together and covered with thick fat. In a laying hen it should always be possible to feel the gizzard through the abdominal region. A moderately fat hen showing a soft pliable abdomen is at the time of handling quite likely producing well, but she should be watched and culled if the fat becomes hard and rubbery. A condition of excessive fatness is often seen in the heavier breeds.

1A. 1B.
See also following page.

2A. 2B.
See also following page.

3A. 3B.

Column A represents an Australorp in full production.

Column B represents an Australorp out of production.

1A. Note full moist vent of a laying bird, while (1B.) shows the dry, shrivelled vent of the non-producer.

Again, notice the four finger capacity of the layer. The fair capacity shown in 1B. is due to the presence of surplus fat in the abdominal region. This fatty condition has prevented the abdominal muscles from drawing the breast close to the pelvic bones, so giving a false measurement

2A. shows a good pelvic span

2B. The small span of a non-producer.

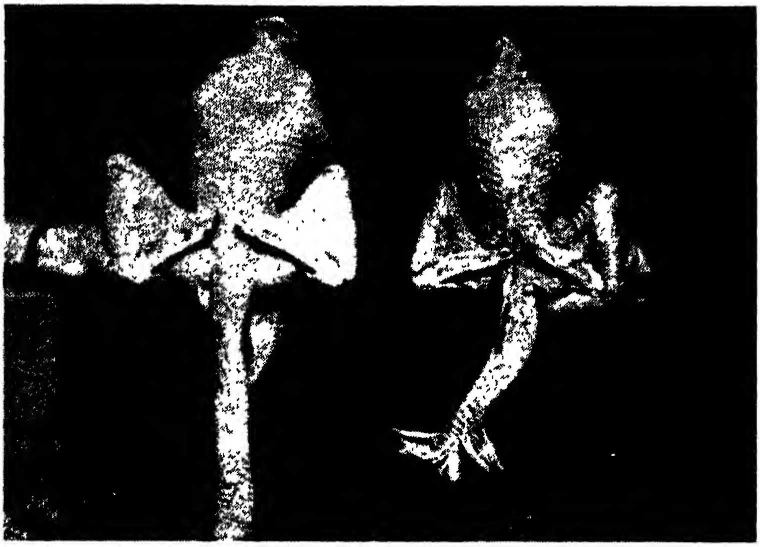
3A.: Clearly shows the thin, pliable nature of the pelvic bones Note also the condition of the vent (See 1A)

3B. Contrast, both thick fat formation on the pelvic bones, and dry condition of vent with 3A.

Apart from overfatness two other conditions are sometimes found in hens which result in a good capacity although the birds are not producing. The first of these is "internal laying," a condition resulting from the dropping of yolks into the abdominal cavity instead of into the oviduct. This results in the accumulation of yolks in the abdominal cavity which keep the abdominal muscles extended. The other condition that can be misleading is that of "dropsy" or "water-bag." A cyst develops in the abdominal cavity, becomes filled with fluid and can grow to considerable dimensions. The fluid can be felt through the abdominal skin. With both these conditions non-productiveness will be evident by the vent being dry and wizened and by the pelvics being practically closed (one finger).

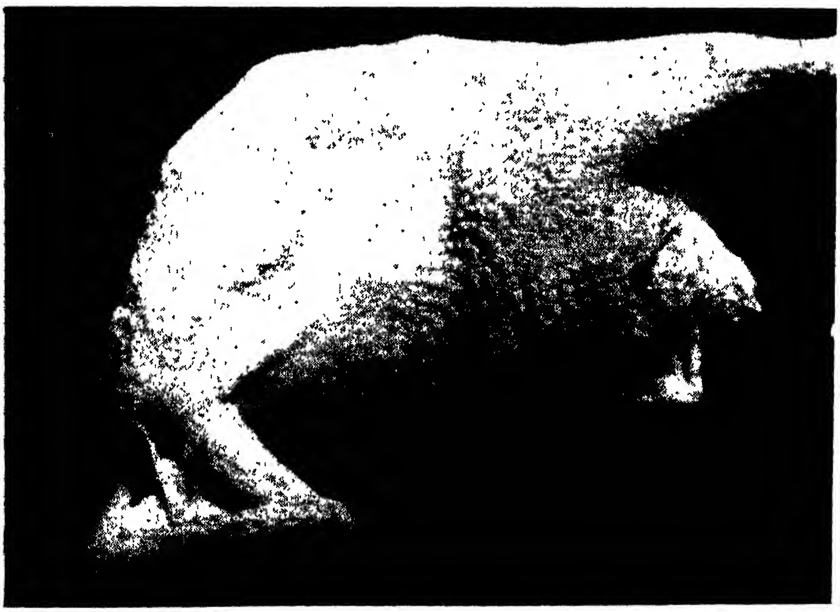
Capacity is sometimes used in a more general and broader sense to describe the general body measurements of the bird. A high producing bird invariably has a long back. The length of the back in a good white leghorn hen should be approximately 7½in., she should also have a long breastbone, as a long breastbone is better able to support the internal organs, and displaced oviducts and internal laying are, therefore, less likely to occur. The depth of the bird or the distance between the backbone and the breastbone towards the anterior (front) end of the

body in a white leghorn hen should be in the vicinity of five inches. The back of the bird should be flat and wide with good width extending to the base of the tail. The width of the bird through the centre of its body should be in the vicinity of 5in. so that a good producing white leghorn hen has a rectangular shaped body as illustrated:—



1A. 1B

1A. Illustrates the desirable broad flat back of a good layer (Australorp). Notice the width at the tail. But by contrast notice the narrow sloping back in 1B. (White Leghorn). Also notice the lack of width at the tail.



A well developed body as pictured, is fundamental to heavy laying and eggs of good size. The carcase is that of an Australorp hen which was killed while still in production. Note the backbone and breastbone parallel to each other.

The Moult.—Persistency of production is measured by the condition of the plumage during the summer and autumn. The time at which a laying hen goes into her moult is a more reliable guide as to persistency than the pigmentation changes discussed under another heading.

The hen that moults early (November-December) is the hen that has laid poorly throughout the previous laying season and is the hen that will take her time over the growing of her new feathers, i.e., she will hang in the moult and be out of production for a long period—from six to seven months. During this time the good birds in the flock are keeping this "cull" bird, and the farmer is feeding her for no return. The good producer, on the other hand, is the bird that moults late (March-April), moults for a short period (12 weeks) and comes back into production very often before the early moulting hen that has been out of production for several months.

Here then, we have a body feature which is of the utmost importance and one which can be used by even the least experienced as a means of ridding the flock of birds that will never pay to keep for a further year's laying. Eleven months' continuous production is expected from pullets hatched in season so that if a flock of pullets commences to lay in March at six months of age, they should continue laying until the following February.

The old feathers are usually retained by a laying bird which lays regularly. Should she cease production for any other reason than for sickness or broodiness, she will lose her feathers.

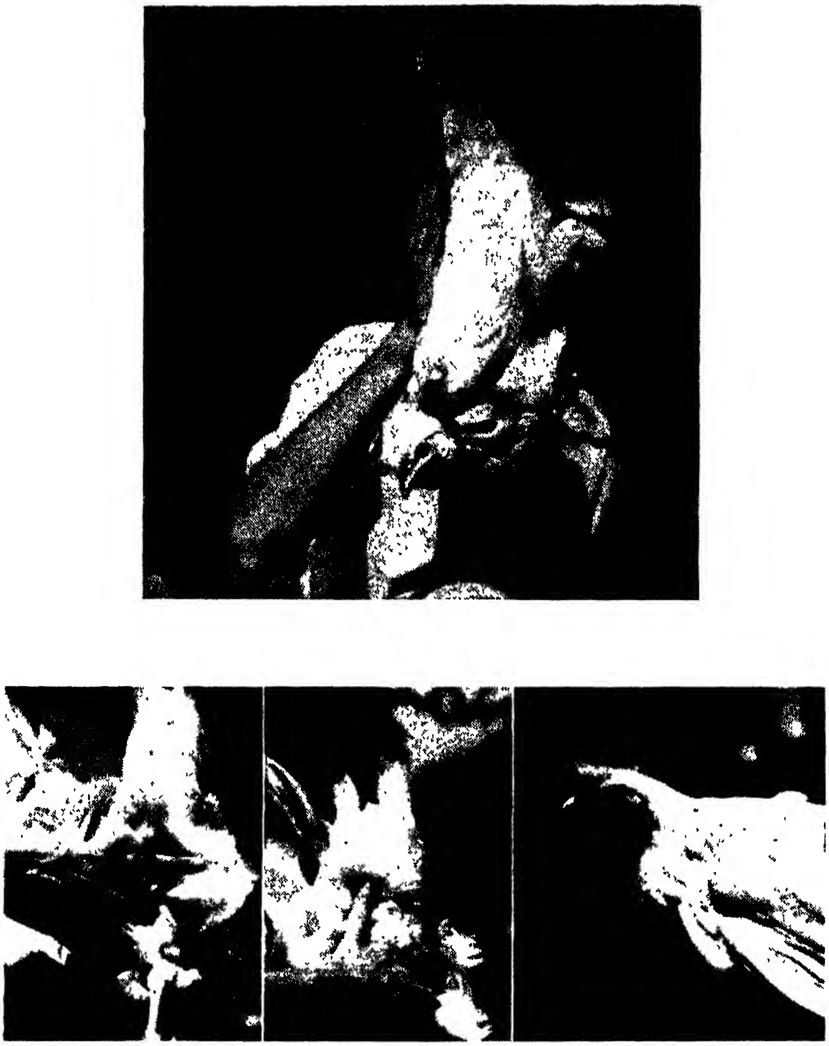
The above bird laid 111 eggs from April to mid-October, when a partial moult took place and she ceased producing. The capacity measurement was taken 45 days after the moult commenced (see neck). The measurement was large because of excessive fat in the abdominal region. This bird is unlikely to return to production till the following June, and is therefore a liability.

The neck moult discussed under the heading of "culling the pullet flock" is sometimes experienced by a bird without any loss of production, or by a slight loss in production. When the moult extends beyond this neck moult stage, however, the hen has entirely ceased producing. After the neck, the back loses its feathers then the wings and the body in that order. The moult seldom extends to the back without involving loss of feathers from the wings also.

These photographs are of a pullet which laid well (121 eggs) from April until November 9th, when she went into a moult and out of production. The photographs (taken November 24th) show a loss of feathers from the neck and the limp condition of the comb This type of bird is readily recognised among a flock and should be culled immediately as it will possibly be June before she returns to production

A few outstanding hens have the ability to moult and lay at the same time, on the other hand poor producers invariably cease production before starting to lose their feathers. Because of this, the poor-producer should be deleted before she moults by means of capacity tests, texture of the comb, and the general feel of the body, and be culled from the flock just before the last egg for the season is laid. The average time taken by a low producing hen to complete the moult is five months.

A continuous moulter is a poor producer and can be readily detected in the flock by the spotless condition of her new feathers. New feathers are easily distinguished from old feathers. The shaft of a new feather is soft at the body end, often filled with blood and sappy in appearance. The feather vane itself is close, unsplit and unbroken at the tip. The quill of an old feather is hard, hollow at the base and the shaft is filled with white pith.



Four photographs of a White Leghorn hen which tell their own story. The "wedge-shaped" body, capacity (one finger) and pelvic span (one finger) show the bird to be out of production. The "snow white" appearance of the bird's plumage, together with the loss of feathers, particularly in the neck region, suggest the bird to be a continuous moulter and a low producer.

These photographs were taken late in November, eight months after she had become sexually mature and at a time when she should have been producing many eggs per week. During the eight months she laid 27 eggs and at the time of photographing was out of production

The observant flock owner is able to detect this type of bird a few weeks after she commences production, and if he wishes his farm to pay, he should waste no time in culling her.

This bird was selected as one of a team of birds to compete in an egg laying trial. The selection being based on the good development and excellent body features shown by the bird when she was approximately 5½ months old. This indicates the uncertainty of any one bird as a producer and the necessity for continuous, systematic culling.

This bird shows good head points and the comb is relatively full and bright. In culling this type of bird, head points, and the appearance of the comb are not reliable indications as to the hen's worth as a layer. This bird could, however, be identified as a cull bird because of her small capacity and condition of her plumage.

Birds carrying "pin" feathers are difficult to pluck. From this point of view alone, moulting, "cull" birds should not be retained on the farm until the new feathers begin to grow.

The above bird has moulted, and a new growth of pin feathers have appeared. Birds in this condition are often marketed. This is not in the best interests of the farmer or the poulterer, as birds in this condition are very difficult to pluck

The wing feathers of a hen number approximately 29, made up of about 14 "secondary" feathers placed at the end of the wing nearest the fowl's body and separated from 10 "primary" or "flight" feathers at the other end of the wing, by a short feather called the "axial" feather. About four small "finger" feathers are situated at the extreme tip of the wing. The rate at which the "primaries" grow can be used to differentiate between the rapid and slow moulter. Primary feathers moult in numerical order starting from the feather nearest the axial feather and ending with the primary nearest the wing tip. Poor layers moult slowly and drop one primary feather at a time. Rapid moulters on the other hand sometimes drop two or more primary feathers together, and the replacement feathers will grow at equal rates so that this type of bird when handled will show two or more growing primaries of equal length. Birds of the latter class are invariably late moulters showing them to be persistent layers. Rapid moulting is not only seen in the wing feathers of good producers but also in the loss of the body feathers generally. Because of this it is common to see a late, rapid moulting hen practically devoid of feathers and showing many bare patches over her body. In years gone by, because of her dishevelled appearance, this type of bird was discarded. This is not the practice today, however, as the worth of this type of bird is appreciated by the average farmer.

The Comb, Wattles and Earlobes.—The development and the functioning of the reproductive or egg producing organs is accompanied by an increased blood circulation in the comb, wattles and earlobes. This is evidenced by the large, full, glossy appearance of these parts in the laying hen and are most noticeable when the pullet is at the height of her production. This gloss and prominence is lost as the laying season advances. Near the close of the laying season, although the redness is retained, the comb in particular, as it is the most prominent organ of the three, loses its fullness, becomes wilted and reduced in

size. When production ceases these parts become small, contracted, dry and usually covered with a white scale. They are cool to the touch which suggests reduced blood circulation and a dormant condition of the egg producing organs.

The feel of the comb, which is known as "comb texture" gives a further guide as to whether a fowl is in production or not. The hen that is laying many eggs in the week has an increased blood circulation through the comb and will have a comb which feels like the "lobe" of the human ear. It is supple yet firm, pulpy yet strong, soft inside although it may be rough outside—such a comb denotes a "fine texture." The non-producing fowl on the other hand or the hen that is laying a few eggs in the week will have a comb which feels hard (inside) to the touch—one which feels like the brim of a felt hat—has no pulpiness and no body—such a comb has a "coarse texture." Between these two extremes of fineness and coarseness a wide range of different intermediate "feels" are to be found in birds showing intermediate rates of lay, but in culling laying hens little attention should be taken of these intermediate "feels" and "comb texture" should only be exploited when determining between high and low producing birds. When examining birds at the end of the laying season "comb texture," as indicated by a hardening of the comb, indicates the nearness or otherwise of the last egg for the season, e.g., laying hens which when examined in December-January can be said to be rapidly nearing the completion of their seasons lay, if in addition to a reduced capacity and excessive fatness, they show a hardening of the comb (coarse texture).

It should be noted, that pullets generally have finer textured combs than hens. This applies to birds both in and out of production. In the writer's opinion "comb texture" as a guide to productiveness is of greater value when applied to light breed hens such as the White Leghorn than when applied to Heavy Breed hens, and Crossbred (W. L. x Aust.) hens which naturally have harder combs.

These photographs show a hen that has been out of production for some time (left), a hen in full lay (centre) and a hen that has just ceased production (right).

The bird on the left has a hard textured, shrivelled up comb. The centre bird has a soft textured, full bright red comb. The bird on the right has a comb which has lost its turgidity and become limp, just before commencing to shrivel.

If a bird is to be culled it should be discarded just as the comb loses its fullness and becomes limp as in the case of the bird on the right. A bird in this condition if not already out of production soon will be and will not have lost very much weight. The bird on the extreme left on the other hand should have been marketed weeks before her photograph was taken (late November). Since ceasing production she has eaten much valuable food and her carcase value has decreased because of her lost condition.

Good head left and poor head right. The bird on the left laid 305 first grade eggs in 336 days. Note the refined, deep, well balanced head, well developed comb and wattles, bright bold eye and strong beak of this bird. Compare with the poor head of the bird on the right which suggests the bird to have a weak constitution. This bird has a long head ("crow headed"), and a long, weak looking, hawk like beak. The eye is dull and sunken, and the comb and wattles poorly developed. The head points would, in themselves, provide sufficient reason for culling this bird.

It is very difficult to describe tactile sensations without demonstration. The farmer should therefore arrange to be shown the correct way to determine comb texture. Comb texture does not refer to the outside appearance or feel of the comb so much as to the inner feel, experienced when the comb is grasped firmly between the thumb and the forefinger.

Fine texture in good birds and coarse texture in poor producers is not confined to the comb but is evident throughout the bird from its head down to its shanks, which in a good bird are lean and flat sided, and not round and thick with coarse scales.

The Structure of the Skull.—It is doubtful if head points alone are sufficiently reliable to be used in determining between profitable and unprofitable birds. It is rarely, however, that a hen showing a number of very good head points lays few eggs and when considered in conjunction with other body features, "head points" do provide a guide as to the worth of a bird as an egg producer. Head points are particularly valuable in ascertaining the "vigour" of a bird. Some of the more important head points found in good producing hens are:—

1. The top of the skull should be flat from side to side with the eye set well up towards the comb.

2. The width of the skull should be maintained between the eye and the base of the beak.

3. The distance from the top of the head (base of comb) through the eye to the base of the wattle should be nearly as great as the distance from the front of the lobe to the point of the beak. Birds with long narrow heads and long narrow beaks are termed "crowheaded." This type of bird usually lacks vigour as indicated by a small body, tapering backs and the laying of small eggs.

4. The skull from the front to the rear should be level on top. The "skull line" should be a gentle curve and should not rise to an apex over the eye forming the so called "gable" head. A "gable" head is frequently found in poor layers that are fat and beefy.

5. A clean cut face free from feathers with prominent bright clear eyes and an absence of wrinkled skin about the head is a mark of good quality.

Disposition and Temperament.—The good layer is usually friendly, tame, alert, active, always busy, among the last to take to the roost and the first off in the morning. Her appetite is always good as shown by her full crop at night. A good hen running on hard ground usually has worn toenails.

Culling Growing Chickens.—Chickens should be culled at the time they are taken from the hatching tray and before they are placed under the brooder. This is one of the most important times to cull. It gives the farmer his first opportunity of partially relieving himself of future financial worries and he should avail himself of it.

Inferior chicks are often retained and reared to an approximate age of six months before the farmer is convinced that they will be unprofitable. When reared to this age the temptation to carry the inferior pullets for a further few months in the hope that they will lay a few eggs is very great. Unfortunately these hopes never materialise and the money spent in rearing and feeding, not forgetting the labour involved can never be recouped. What a saving it would have been had these birds been culled when a few days old.

By the end of the 21st day of incubation the chicks should be out of the egg and completely dried off. It is bad policy to give weaklings a chance to survive even for a few days. Weakly chicks which result from faulty incubation. from constitutional weakness in the breeding stock, or from faulty feeding of breeding stock will never develop into profitable birds. They only serve to jeopardise the health of normal chickens in the batch, insofar as the most important chicken diseases are highly infectious or contagious and weakly chicks readily succumb to these diseases should they appear.

To be successful in poultry farming, the farmer must buy good quality stock. An extra pound per hundred for day old pullets bred from stock he knows to be reliable compared with chicks from stock indiscriminately mated is well worth the extra outlay. It is in the hatchery mans own interest to consign healthy, evenly developed chicks to his clients. If however, weaklings can be found amongst bought chickens, and it must be remembered that weaklings can result from matings of first class stock as well as from matings of inferior stock, these should be destroyed immediately.

In culling chickens, a general survey of the batch will give a clear picture of the average size of the chicks and any weak or undersized chicks can be easily detected. The chicks should be a ball of fluff and have plenty of body. Evidence of sticky patches on the down indicates too high a humidity during the incubation period. Chicks subjected to these conditions often have difficulty in hatching but under no circumstances should a chick be assisted out of the shell. A chick that cannot get out of the shell as a result of its own efforts is not worth keeping.

Individual examination may indicate chickens with crossed beaks, weak legs, very short abdomens or other deformities. The absorption of the yolk sack should be complete with the opening completely healed over Similarly, the vent should be clean and those chicks showing pasted up vents should be destroyed. The eyes should be bright and the beak and shanks of yellow coloured breeds full of pigment. The beak and shanks of white skinned birds should be tinged with pink.

The chicks should be grown gradually so that light breed pullets commence laying at six to six-and-a-half months of age and heavy breed pullets at six-and-a-half to seven months of age. Constant culling should be practised during this time and any chicks which lag in growth behind the average of the flock should be culled. Chicks of the same age should be run together and under no circumstances should "runts" of one group be removed to a group of younger chicks. These "runts" will never grow into profitable hens. When not of a genetic nature the stunting is frequently the result of worms, pullorum or coccidiosis, and to introduce these potential havoc-causing "culls" into a group of clean, evenly grown, well developed chicks, is sheer folly.

Growing pullets can be selected for future production with a greater degree of certainty when they are 15-18 weeks of age than at any other time. Pullets which show the greatest development at that age become the best layers, everything else being equal. Those pullets that feather quickest usually develop into the best layers.

A.

A. shows an evenly grown flock of leg-bar pullets

B.

B.: Contrast an unevenly grown flock with A. Notice the two "culls" in the white flock.

The isolated "cull" birds (marked X) can easily be seen amongst the birds in this flock of well developed 4-months-old Australorp pullets. (Photos taken late November.) It is unlikely that these poorly developed pullets will ever be profitable hens. Should disease come along they will be the first to contact it. The pullet in the left foreground has raced to maturity to the detriment of her body size. When she commences laying she will probably lay many small eggs. After being in production for several weeks she may go into a neck moult and cease producing for some weeks.

Culling the Pullet Flock.—Before discussing this aspect of culling there is a point in management which must be brought to the reader's attention as it is of the utmost importance to the welfare of the pullet flock. Pullets in the first few months of lay are very susceptible to even the slightest change in management or feeding and should laying pullets be moved to new quarters or be fed a different ration production might easily drop from 40 per cent. to 15 per cent. within a few days and this will quite likely be accompanied by a general neck moult which may develop into a body moult. If this occurs several weeks' production will be lost at that period of the year (April-May) when egg prices are at their peak. Because of this the pullets should be moved from the rearing yards to the laying sheds three to four weeks before the first egg is dropped.

The ideal time for a pullet to lay her first egg is between 180 and 215 days of age. Light breed pullets should commence laying between the age of 6 and 6½ months and heavy breed pullets which should take slightly longer to develop. 6½ to 7 months.

Very early laying is undesirable, as once egg production commences body development is very much slowed down. A bird must have a good body if it is to withstand the strain of high egg production later on. Conversely very late laying is undesirable because delayed sexual maturity goes hand in hand with poor annual production.

Assuming that the least developed pullets have been culled from the flock at the 15-18 week old stage there should be only a few birds to discard at the time the pullets are transferred to the laying sheds. Even though the management and feeding be ideal most farmers find that some of their pullets go into a neck moult

shortly after commencing production. In these birds the pigment returns to the vent, eyelid, etc., and the bird takes a holiday. If the percentage of pullets that develop the neck moult is small it shows that these particular birds are just not built for egg production and the quicker they are marketed the better.

Even pullets which show first class body features and are well developed when five to six months old may break down after being in production for a short time or fail to develop into profitable hens. Support to this statement is given by the relatively high percentage of birds which after being selected as competition birds in egg laying trials break down, fail to develop, and become unprofitable during the course of the trial. It is, therefore, important to keep a particularly watchful eye on the pullet flock until June or July. Birds which warrant retention until this time of the year should have little trouble in holding their own (providing of course disease does not intervene) until the fowls with poor persistency begin to show their colours in late October. From then until February the pullets will require heavy culling as they go out of production. With experience birds can be detected before they actually go out of production, and every poultry farmer should aim at acquiring this ability to detect those birds that are nearing the end of their laying season. Those that cease production during October-November-December should be automatically disposed of, so that the percentage production during November-December does not fall below 50 per cent. and during January and February 40 per cent. and 33 per cent. respectively. More sympathetic consideration should be given to those that cease production during February. Taking into consideration the mortality of the pullets and the suggested rate of culling, approximately one-half of the original birds in the pullet flock should be retained to commence the second year's production and these should consist of late moulting pullets. To ensure satisfactory production during October-January a monthly night culling of the flock is recommended during these months.

The "breakdown" involves not only cessation of egg laying but very often rapid loss of weight. The heavy mortality experienced at this time of the year is taken for granted by the farmer who does not take heed of foreboding signs which tell him to cull, and cull quickly. A week wasted at this time of the year can easily mean the difference between a carcase which returns 6s. or 7s. and a corpse which is valueless.

A percentage of the pullets will show signs of becoming coarse during December and January after the flush laying season. This is particularly evident in flocks of heavy breed and cross bred hens. A coarse hen is typified by having a skull which is wide across the top and deep above the eye, with overhanging eyebrows, small sunken eyes, a large comb of coarse texture, wrinkled face carrying plenty of feather, and very thick pelvic bones covered with fat. Such a fowl will be heavy and inactive. Because of excessive fat carried in the abdominal cavity, the abdomen will feel hard and ridgy to the touch.

The habits of the birds and a number of different body features when taken individually or collectively serve to identify the "cull" bird that ceases production after 8-10 months laying. The most important of these features are:—

1. Reduction in capacity to two fingers.
2. Reduction of pelvic span to one finger, and the pelvic bones becoming rigid.
3. Thickening of the pelvic bones because of the deposition of fat on them.

4. A thickening, hardening, shrivelling or apparent wasting in the abdominal region. Heavy breed hens very often become excessively fat as they cease production and the fat is noticed particularly in the abdominal region, where it forms a hard layer beneath the skin. In this type of bird the pelvic bones are also invariably covered with fat. This abdominal fat prevents the abdominal muscles from drawing the breast bone towards the pelvic bones and consequently a "false capacity" is shown by such birds, which also weigh heavy and usually have heavy overhanging eyebrows, a coarse head and roughly textured combs.

   Many birds on the other hand and particularly light breed hens, show lightness, signs of wasting away and frequently a whitish-greyish diarrhoea. This condition is commonly referred to as "going light." There is no cure for it and the quicker these birds are marketed the better. They will never regain weight and very often die if held for two to three weeks. Broody birds that have been on the nest for any length of time often lose weight. This lost weight will be regained by the bird after a period in the broody coup.

5. A contraction, shrivelling and drying of the vent which becomes round instead of crescent-shaped.

6. A shrivelling of the comb which becomes pale and covered with a whitish scale. The comb becomes coarse in texture and the wattles and lobes inconspicuous, rough and dry.

7. In yellow-skinned birds, pigment returns to the vent, eye ring, ear lobe, beak and shanks in that order when production ceases.

8. The early moulter invariably ceases production before moulting commences so that the farmer should not wait until the fowl moults, but should look for other features in the early moulter, which denote the fowl to be out of production.

The Time of the day in which to Cull.—Day-old chicks should be culled whenever they are taken from the hatching trays.

Daylight culling of growing chicks and the selection of breeding stock for type is more convenient than night culling, but with the laying hen, in addition to day culling, night culling is advocated.

During the summer months laying birds go out of production daily. To be able to recognise the pullets and hens when they go out of production during October, November, December and January, is one of the most important aspects of culling.

The bird that shows aloofness, sluggishness and a reluctance to eat (particularly the morning wet mash) will also show a shrivelling of the comb and can be assumed to be out of production. She should be caught with the least possible disturbance to the other birds in the flock (a crab net is very useful for this purpose). It will be noticed that her comb is thin, hard to feel, and that she has a small abdominal capacity.

When some birds go out of production however, they do not immediately show signs of having done so and it is only by handling these birds and noting their reduced capacity, curved in pelvic bones, excessively fat condition, coarseness, tightness of the abdominal skin or marked loss of weight, which tells that they are out of production or are likely to be in the very near future. Because of this, monthly

night inspections of the roosting hens is advocated during the early summer months. The light from a hurricane lamp will give all the light that is necessary and handling of the birds without the aid of any light at all is usually sufficient for the operator to make a decision. The operator should work up and down the perching birds in a systematic manner so that no bird is missed. The capacity shown by the bird, the feel of the abdominal region, the feel of the crop, the condition of the pelvic bones, the width of the pelvic span and comb texture should be noted.

Considerable speed can be attained by the experienced night culling operator as the general feel of the fowl's abdominal region will usually provide sufficient information for him to confidently judge the majority of the birds without lifting them from the perch.

An early evening examination of roosting birds that have been given a liberal feed of grain just before going to roost will, by the relative fullness of their crop, give useful supplementary information as to whether they are out of production. The crop should be felt with one hand and the abdominal region with the other. The bird that is out of production will have little in its crop in addition to a small capacity and tight abdomen. On the other hand, the bird that is in full lay will invariably show a full crop. However, so will the hen that is using its food (particularly grain) to produce fat and not eggs. This fatness will be detected at the rear end of the bird.

Night culling of laying hens at the end of their laying season is quick, and little effort is expended by the operator. The laying hen is a very sensitive piece of mechanism and night culling when quietly, yet efficiently carried out does little to upset this mechanism.

Clearly the above bird is a "cull," and a liability to the flock After laying satisfactorily for only eight months (March-October), she is now resting, as evidenced by the shrivelled appearance of the comb and the clean, new nature of h r plumage. This bird will probably not return to production until June. She will therefore be a flock passenger for the intervening eight months.

SELECTING BREEDING FOWLS.

Selecting the Breeding Male.—The true worth of a male as a breeder is measured by his ability to transmit high egg-producing qualities to his off-spring. This can only be accurately determined by means of the progeny test. This test consists of mating a male with a number of females and keeping a record of the eggs laid by the daughters, egg-size, economic use of foodstuffs, broodiness etc. Pullets with high winter (first few months of laying) production as a rule give good yearly production and by recording the egg production of pullets during the winter period pre-potent sires can be selected and used as breeders in the following breeding year. In this way a breeding seasons use of a valuable cockerel is not lost.

If vigour is to be maintained in poultry flocks the first requirement to be looked for in a breeding cockerel is this essential. Lack of vigour is seen in cockerels with small body size and comb development, cow hocked, drooping rumps etc. The cockerel with vigour is alert, active, very often savage, and of a commanding disposition. He will have a short well-curved beak, broad deep head and a full face with a prominent clear bright eye. The comb face and wattles should be of a healthy red colour. The neck should be reasonably short and arched, the legs of medium length and set squarely under the body with hocks straight and wide apart. Pronounced masculine features should dominate all sections of the bird, even to the bright sheen on the plumage. He should conform to type. The breast should be prominent, he should have wide shoulders and good depth from the centre of the back to the centre of the keel. The reproductive organs are not developed as they are in the actively laying hen, and in well-bred cocks the tip of the keel slopes up giving a small capacity. The pelvic bones are close together. A bird with a crooked breastbone or showing thumb-marks or side-sprigs on the comb, should not be used for breeding purposes.

Precocious males usually show good fertility, but are likely to be fine boned and undersized for the breed. Continued use of early maturing males may therefore have a tendency to reduce the size of the offspring, and will eventually affect the size of the egg.

A senior officer in the United States Department of Agriculture claims that egg production in the United States increased more between 1935-1942 than during the previous 25 years. He attributes this to the increased use of breeding males from lines of high producing ancestry that are able to transmit high egg producing ability to their daughters. When these progeny tested males are mated to females which have proved themselves good layers we can expect maximum improvement in egg production.

Selecting Breeding Females.—High egg production has been shown to depend largely upon five inherited characters: early maturity, high intensity or rate of lay, non-broodiness, no winter pause, and persistency or ability to lay over a long period. Persistency is the most important of these characters and fortunately is the most accurately determined by culling methods.

Early Maturity.—Very early maturing pullets which show small body size and very slow maturing pullets, should never be used in the breeding pen. In selecting birds for early maturity the pullets should be handled at six-and-a-half months of age. Those with a large moist vent, enlarged soft pliable abdomen, a wide pelvic arch and good capacity should be leg banded and regarded as

possible future breeders. Generally speaking those pullets which commence laying between the ages of 180-215 days will give the greatest first year production.

High Intensity.—High intensity or ability to produce many eggs in a week is measured by capacity, also by the feel or quality of the skin and abdomen, and by the thickness of the pelvic bones. Fat goes out of the body with production so that a heavy producing hen a few months after she has come into production will have a soft velvety skin, soft pliable abdomen, and thin pelvic bones. A bird showing these good qualities should be leg banded with a band of a different colour than that denoting early maturity.

Broodiness.—Broodiness is opposed to egg production and is inherited. Fowls which show signs of broodiness should never be used in the breeding pen. This is a particularly undesirable feature in light breed hens and the White Leghorn hen owes much of her egg producing ability to the low incidence of broodiness found in this breed. When broodiness is considered strictly in the light of egg production we can generalize by saying that hens showing a high incidence of broodiness are low producers and birds which repeatedly go broody should be culled from the laying flock. It is frequently found, however, that two or three periods of broodiness in a laying season are shown by high producing hens. In such hens rate of laying is usually accelerated immediately following a broody spell and some of the lost production time is thereby recouped.

The economic loss caused through broodiness is largely in the hands of the farmer. In the first place he should breed against it and secondly he should isolate broody birds at the first sign of broodiness. Should a broody bird be left in the nest for a number of days, five or six weeks production may be lost, but if a nightly inspection of nests is made and broody birds are removed to the broody coop immediately, only 12-15 days production will be lost.

Winter Pause.—Winter pause in production is usually accompanied by neck moulting, closing of the pelvic arch, hardening of the abdomen and in yellow skinned breeds by a return of pigment to the vent. beak, etc. Pullets hatched in season that receive good management should not show winter pause. Those that do should not be used in the breeding pen.

Persistency.—Persistency is the most important single factor concerned with high egg production. The highest producers of the flock can be identified with a high degree of accuracy by examining the birds for persistency and supplementing these examinations with those for high intensity.

Hens in their first year of lay should produce for 11 months and highly persistent birds will lay for 12 or more consecutive months. High producing birds after 11 months' production will carry their old feathers in the wings and throughout the body, will have a large moist vent, bright full comb and will not be carrying pigment in the beak, shanks, etc.

In selecting fowls for the breeding pen we should not base our selection on egg production alone but should select those birds that have laid at least 200 2 oz. eggs in their pullet year an dwhich also showed good body development and weight at the time they became sexually mature, i.e., at the time they laid their first egg. This is important if we wish to maintain body size in our flocks of the future.

One way in which mismanagement can cause a serious loss of production is through leaving broody hens on the nest and thereby allowing the body to shrivel and the reproductive organs to fall into disuse. Result: An extended broody period of 5-6 weeks and no eggs. These photographs are of a broody Australorp hen that was left on the nest too long. The pelvic bones have practically closed and the capacity has been reduced to two finger widths. If this bird had been removed to the broody coop on the first night of showing signs of broodiness the bones would not have closed and the hen would probably have been back in production within 10-15 days.

Birds that are selected for the breeding pen must have health (including freeness from Pullorum disease), vigour, size and trueness to standard type and colour. Hens which "lay themselves out" are of no use in the breeding pen and should be disposed of after finishing their laying season. The breeding hen should be the high producing hen that maintains physical condition.

Egg Size.—If the farmer wishes to maintain egg size in his flock he should trap nest his potential breeders at the time they commence laying in their pullet year. He is thus able to identify and leg band any pullet that does not lay a 2 oz. egg by the time she has laid her 20th egg. Such a pullet should never be used in the breeding pen as egg size is hereditary. A pullet that lays underweight eggs very often lays eggs weighing 2 oz. and over after she has passed through her first moult. Such a hen may be a good producer, even though she lays small eggs and be retained in the flock after her first year lay because of the number of eggs she lays. If appropriately leg banded, however, there is no possibility of her being used as a breeder in her second or subsequent years of laying.

CULLING CHART.

JUDGING FOR PRESENT PRODUCTION.

Character.	Laying Hen.	Non-Laying Hen.
Vent	Large, dilated, oblong, moist, bleached.	Small, contracted, round, dry, pigmented.
Pelvic Bones	Flexible, thin and wide apart	Rigid, coarse, close together
Comb	Large, red, full, glossy	Small, pale, scaly.
Wattle and Lobes	Prominent, soft, smooth	Inconspicuous, rough and dry.

JUDGING PAST PRODUCTION.

Character.	Long Laying Period.	Short Laying Period.
Vent	Bluish, white, bleached . . .	Flesh coloured.
Eyelids	Thin and edges white . .	Thick, yellow tinted.
Eye	Prominent, keen, sparkling	Listless, sunken.
Earlobes	Enamel white	Yellow tinted.
Beak	Pearly white	Yellow tinted.
Face	Clean cut, sunken	Full, wellfleshed, yellowish.
Shanks	White, flat, thin, creased	Yellow, round, smooth.
Plumage	Worn, soiled, lifeless, close-feathered	Signs of moulting, loose-feathered.

JUDGING RATE PRODUCTION.

Character.	High rate.	Low Rate.
Keel	Slopes downward . . .	Slopes upward.
Pelvic Bones	Tips thin, point straight out . . .	Tips thick, curved in.
Capacity	Four to five fingers	Two fingers.
Abdomen	Soft, pliable, dilated	Fatty, hard, contracted.
Rump	Broad, width carried back	Narrow, cramped.
Lateral Processes	Prominent, pointed outward....	Hard to find, pointed inward.
Skin	Soft, thin, loose, silky	Thick, dry, underlaid with fat.

ACKNOWLEDGMENT.

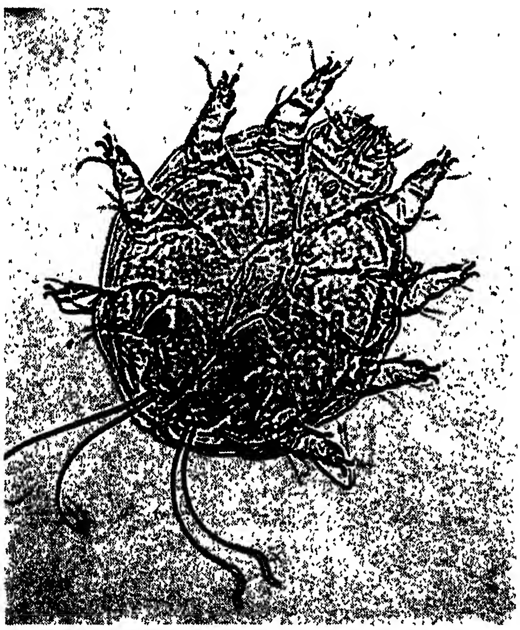
Thanks are due to Mr. C. Balmer (Govt. Photographer) for the photographs for this article.

THE SHEEP ITCH MITE (PSORERGATES OVIS).

C. R. TOOP, Acting Chief Veterinary Surgeon,

Department of Agriculture.

THE sheep itch mite *Psorergates ovis*, was recorded in Western Australia for the first time a few weeks ago. This parasite was first detected in New South Wales in 1940 and since that time it has been reported from all of the other States. There is reason to believe, however, that the mite has existed in Australia for many years and that its recognition has been delayed owing to the similarity of the symptoms produced to those resulting from infestation with body lice (*Bovicola ovis*). The presence of itch mite had been suspected for some considerable time in this State, but a definite diagnosis could not be made until the parasites were recovered from affected sheep and positively identified.

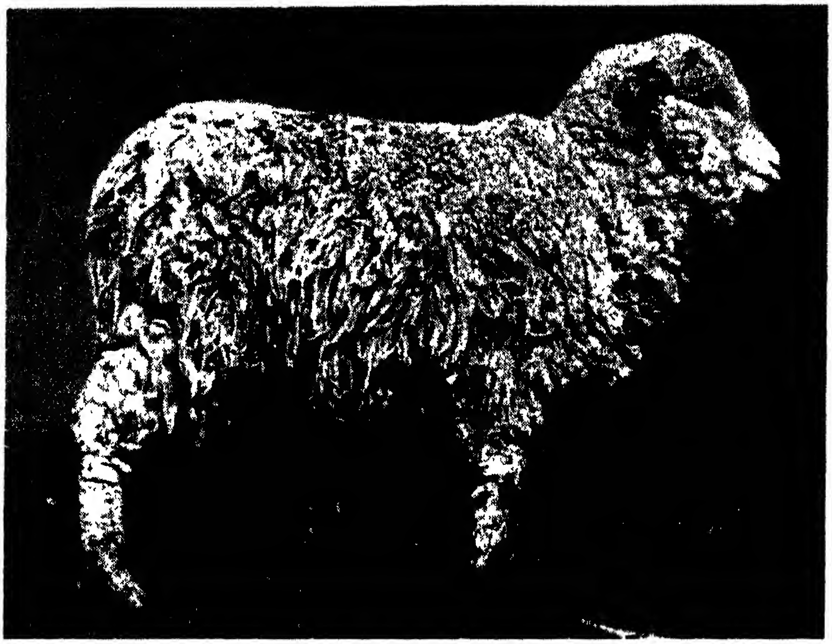


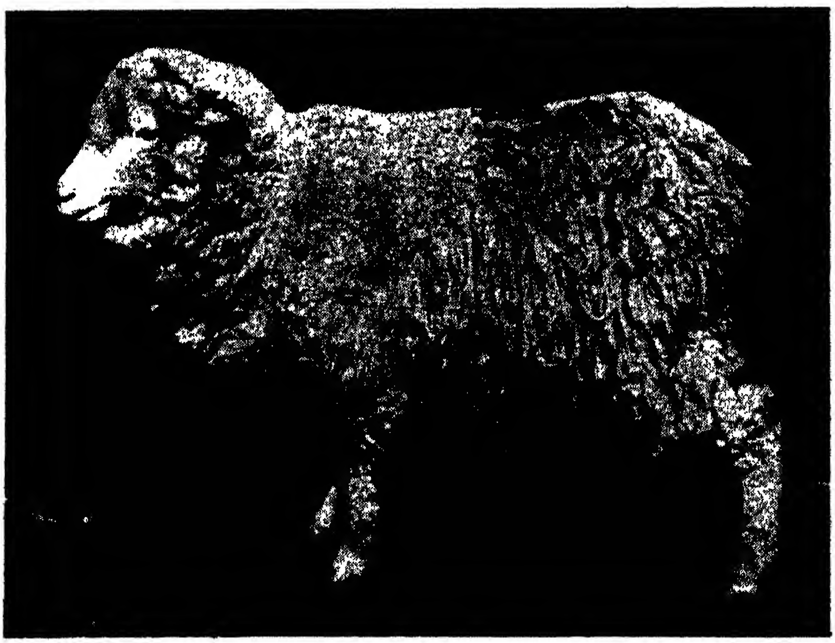
The Sheep Itch Mite (*Psorergates ovis*—female).
(Photo.: C.S.I.R.)

The itch mite inhabits the superficial layers of the skin setting up a chronic irritation which causes the affected sheep to rub against fence posts and other objects and to bite at the wool, so that the fleece presents a torn and ragged appearance and in advanced cases becomes badly cotted and consequently reduced in value. The itch mite is not visible to the naked eye and its presence can only be detected by the microscopic examination of scrapings taken from the skin after the wool has been closely clipped or shaved.

Lime-sulphur dips have proved effective for the control of the parasite, and it has been shown that a single dipping if carefully carried out will completely eradicate the infestation.

The condition has so far only been observed in merinos.





An advanced case of itch mite infestation. Note the torn and ragged appearance of the fleece and the loose tassels of wool hanging from the flanks and hindquarters.

(Photos.: Government Photographer)

Symptoms.

The symptoms of itch mite infestation are very similar to those produced by body lice (*Bovicola ovis*) and a careful examination is necessary in order that the two conditions may not be confused.

In consequence of the irritation caused by the mites there are symptoms of rubbing and biting at the wool so that the fleece becomes torn and ragged and loose tassels of matted wool may be observed hanging from the sides, flanks and thighs. The degree of irritation appears to be mild and it may be necessary to watch sheep at rest in the yards very closely before any rubbing or biting is observed. Occasionally strands of wool may be found adhering to the teeth or twisted round the horns and evidence of rubbing may be found on fence posts, logs and trees in the paddocks.

The same animal viewed from the rear. Note the broad band of wool along the middle of the back which the animal is unable to reach and which appears to be unaffected. The tassels of loose wool hanging from the thighs are very obvious.
(Photo: Government Photographer.)

The earliest symptom of the condition consists of a small whitish patch on the side or flank, from which the infection spreads in all directions but more commonly towards the hindquarters and over the thighs. The infestation apparently spreads very slowly and three to four years may elapse before the condition becomes generalised.

The affected wool becomes stringy in appearance and has a dry spiral-pointed tip. It contains particles of crumbling scurf and may show a slight yellow discolouration. The staple is tender and can readily be broken anywhere along its length. In advanced cases the wool becomes badly cotted and the fibres can be torn apart only with difficulty. Sheep in this condition may be difficult to shear and the value of the fleece is seriously depreciated.

Course.

The spread of itch mite infestation is slow and insidious and several years may pass before it reaches serious proportions in a flock; thus on some properties a few sheep only may be observed to be affected whereas on others up to 20 per cent. may show evidence of infestation. In one flock, which was kept under observation in New South Wales, 15 per cent. of the sheep were found to be affected after a period of eight years.

A sample of the affected wool.
(Photo.: Government Photographer.)

Sheep of all ages may become affected, but owing to the slow rate at which the infestation spreads, it is most frequently observed in older animals, amongst which the most serious cases are always found.

The condition is believed to be spread by the direct contact of infested with non-infested animals and to take place soon after shearing while the wool is short which favours the migration of the parasites. The migration of the mites from woolly sheep appears to be unlikely.

Diagnosis.

When, in the absence of lice, there are symptoms of rubbing and biting with consequent damage to the fleece, itch mite infestation should be suspected. The presence of lice must always be excluded, but this should not prove difficult since these parasites, although small, will readily be detected when the fleece is opened and examined in bright sunlight.

For the detection of itch mite the microscopic examination of skin scrapings is necessary. The mites are not always present in large numbers, and the examination of a number of scrapings taken from different sites on the body may be necessary before a positive finding is obtained.

When the condition is suspected and confirmation is desired, a sheep showing typical symptoms should be forwarded to the Department for examination.

Control.

Experience in New South Wales has shown that itch mites may be controlled by the use of lime-sulphur dips, and, provided it is thoroughly carried out, a single dipping may completely eradicate the infestation from a flock. Dips containing 1 per cent. polysulphide sulphur are employed and these may be prepared from concentrated lime-sulphur solutions now available on the market and commonly used as orchard sprays. These concentrated lime-sulphur solutions usually contain 20 per cent. polysulhpide and when used in a dilution of 1 in 20 will provide a solution of the required strength for dipping. To this must be added a wetting agent such as Agral 3 in the proportion of six ounces to 100 gallons, which will ensure that the dipping solution penetrates and thoroughly wets the fleece. Best results will be obtained by dipping three to four weeks after shearing while the wool is still short, but since lime-sulphur solutions are very irritant to open wounds, treatment should not in any case be undertaken until shear-cuts have completely healed.

The dips in general use for the control of tick and lice in sheep are not highly effective for the control of itch mite. Observations have shown that while both arsenical and rotenone dips will destroy large numbers of mites on affected sheep, they will not eradicate the infestation from a property.

There is some reason to believe, however, that gammexane dips may provide an effective means of control, but until confirmatory evidence is obtained no definite recommendation can be made.

PRE-HARVEST DROP OF APPLES AND PEARS.

By W. P. FEARS, Horticultural Instructor.

MANY apple and pear growers have been, and still are, very much concerned over the very serious losses they incur from fruit that falls from their trees just before and during the harvesting period.

This pre-harvest drop is particularly noticeable in such varieties as Jonathan, Delicious and Cleopatra apples and Bartlett pears.

Spraying carried out in the orchard during the past season using commercial pre-harvest sprays containing alpha napthalene acetic acid—a growth-promoting substance—successfully prevented the drop of a major portion of the crop of Bartlett pears and Delicious apples. Experiments carried out at Donnybrook and Mt. Barker in 1944 showed that the pre-harvest loss of both Jonathan and Delicious apples was reduced to a low figure by the use of "Phyomone" and "Cling Spray," while overseas work has fully demonstrated its effectiveness on various varieties of apples and pears.

Growers suffering loss from this cause may, therefore be interested to try these sprays, which are marketed under various commercial trade names. In this instance "Firmstem" and "Phyomone" were used, but other lines such as "Fruitone," and "Shellestone" may be used in the same way.

At Illawarra Orchard, Karragullen, where an average crop of Bartlett pears would be between 3,000 and 4,000 bushels, all trees, with the exception of three. were sprayed with "Phyomone" approximately 19 days before harvesting was due to commence. All falls were left on the ground until harvesting was completed, when they were gathered and the losses determined.

An average of between 12 and 13 pears was lost per tree from sprayed trees, as against 250-300 fruits per tree for unsprayed trees. The additional fruit retained on sprayed trees was, therefore, in the vicinity of two cases per tree.

I am indebted to Mr. H. Price for details of the work which he carried out on his orchard. As a result of the success attained with the "Phyomone" spray, this grower intends to adopt the same procedure in the coming season.

Tests carried out with "Firmstem" on Delicious apples on the property of Mr. DiMarco at Karragullen demonstrated that a considerable saving of fruit was effected on trees which were prone to pre-harvest drop. The spray was applied on 2nd March, but from results obtained it appears that, if the spray had been applied a week earlier, the losses may have been further minimised.

As satisfactory results from the use of these sprays can only be obtained if the stem of the apple or pear is contacted by the liquid, it will be readily seen that pears with their long stalks lend themselves to this treatment.

In the case of the apple with its shorter stalk and different shape and habit, it is more difficult to spray the stem of the fruit, but with care and a good spray pressure, it can be done on properly thinned crops, and a distinct saving of fruit results.

Although the treated fruit hangs on the tree longer and the general colour is improved, the ripening process is in no way retarded by this spray, and therefore, care is necessary to ensure that the fruit is not allowed to become over-ripe on the tree before picking.

NOTES ON THE TREATMENT OF MASTITIS.

By C. R. Toop, Acting Chief Veterinary Surgeon, Department of Agriculture.

WHILE it is important that the dairy farmer should be able to successfully treat cases of mastitis as they arise it is still more important that the means available for the control of the disease should be effectively applied. Although many advances in treatment have recently occurred, there is still no medical agent that can be relied upon to cure all of the cases of the disease which occur. Some forms of mastitis are amenable to treatment but others will not respond to treatment of any kind. It is therefore essential that unremitting attention should be given to the application of measures designed to prevent the spread of infection from animal to animal and the more efficiently these can be applied, the fewer will be the cases of the disease it will become necessary to treat. Our knowledge of mastitis is still far from complete and even when all of the known preventive measures are thoroughly applied some cases are likely to occur and will require prompt attention.

The earlier treatment can be undertaken the better will be the prospects of success and the less will be the damage inflicted upon the udder tissues by the infection. In its simplest form the treatment of mastitis consists of the frequent and thorough stripping out of affected quarters together with fomentation with hot water and massage with a stimulating liniment such as camphorated oil or some similar preparation. Beneficial results are frequently obtained from treatment of this kind. These results, however, are frequently more apparent than real for although the signs of inflammation may subside and the milk regain its normal appearance, the infection may persist in the quarter. This is particularly the case with chronic streptococcal mastitis wherein the infection once it has become well established usually persists throughout the life of the animal, often to flare up periodically and to inflict irreparable damage upon the udder tissues, slowly but surely impairing the function of the quarter, reducing the milk yield and finally causing it to dry up completely.

It is obvious then that any form of treatment, in order to effect a permanent cure, must succeed in destroying the infection within the udder itself. The means whereby it has been sought to bring this result about have broadly consisted of:—(a) the administration of drugs by the mouth, which, during their excretion through the milk will destroy the infection in the udder. (b) The injection of bactericidal solutions or suspensions into the udder through the teat duct which will come into contact with the organisms causing their destruction. Of the drugs which may be given by the mouth none may be regarded as highly effective. A few years ago the administration of sulphanilamide was frequently advocated, but the results in the main were disappointing and the cost of the treatment is such that it cannot be recommended.

Amongst the solutions that may be injected into the udder through the teat duct probably the best known are the acridine derivatives acriflavine and entozen. Both have given good results in the treatment of chronic streptococcal mastitis. Recently penicillin solutions have been quite extensively employed, but since they have now been supplanted by the much more convenient and equally effective suspension, it is unnecessary to describe the method of their administration. Of the suspensions, sulphanilamide-in-oil and penicillin suspension need only be mentioned.

Sulphanilamide-in-oil.—This is a 38 per cent. suspension of sulphanilamide in mineral oil. A dose of 40 ccs. (approximately 1½ fluid ounces) is used and the treatment is repeated each day for four days; the dose being left in the udder until the next milking. The injection may be made by means of a two ounce metal syringe fitted with a short length of rubber tubing and a teat

siphon, all of which should be sterilised by boiling before use. The quarter should be stripped out before treatment and the teat end swabbed with methylated spirits before the siphon is passed through the teat duct.

Experience in the field has shown that sulphanilamide-in-oil has an efficiency of about 50 per cent. in the treatment of streptococcal mastitis but is very much less effective against staphylococcal infections. In cases where a satisfactory response is not obtained the dose rate may be increased to 80 ccs. and a further series of four injections given. Now that penicillin suspension has become available sulphanilamide-in-oil finds little favour with the dairy farmer.

Penicillin Suspension.—For the treatment of mastitis penicillin has proved much more effective than any therapeutic agent that has so far become available. It can usually be relied upon to cure 80-90 per cent. of cases of streptococcal mastitis, but it is not effective against staphylococcal infections. When it is considered, however, that about 80 per cent. of all cases of mastitis result from infection with streptococci and that less than 20 per cent. are of staphylococcal origin, the value of the drug to the dairying industry will be apparent.

Penicillin is now available in the form of a suspension which is put up in collapsible tubes fitted with a nozzle which may be inserted into the teat duct enabling the drug to be injected direct from the tube into the affected quarter. Each tube contains 25,000 units of penicillin. The nozzle is sterilised at the time of packing and is covered with a screw-on cap which ensures that it will remain in a sterile condition right up to the time it is required for use.

Treatment consists of three injections, each of 25,000 units, repeated at intervals of 24 hours for three days, which, according to convenience, may be given either after the morning or afternoon milking. The quarter should be completely stripped out immediately prior to treatment and the end of the teat should be cleansed by swabbing with methylated spirits before the nozzle is inserted into the teat duct. All of the contents of the tube should be squeezed into the quarter and this should be followed by massage in an upward direction to ensure that the suspension is thoroughly dispersed. The dose injected is left in the quarter until the next milking and while the cow is under treatment the normal milking routine should not be disturbed. Penicillin is non-irritant and does not cause any damage to the udder tissues. Should the response not be satisfactory, a further course of three injections may be given but it must be recognised that staphylococcal mastitis does not respond to treatment with penicillin. Staphylococcal mastitis cannot be differentiated clinically from other forms of the disease, but in cases where doubt exists milk samples may be submitted for laboratory examination, which will enable a definite diagnosis to be established.

Vaccines have frequently been advocated for the treatment and control of mastitis but it is necessary, in the interests of the dairy farmer, to point out that no vaccine has yet been discovered that will either cure or prevent the disease.

In conclusion it must be emphasised that no matter what promise treatment may offer it must be regarded as a supplementary measure and as a second line of defence. Prevention must remain the primary consideration, and unless precautions are taken to prevent infection by the use of hypochlorite solution in the strength required for the disinfection of hands, teat cups and udders, by the provision of adequate facilities for the sterilisation of dairy utensils, by the maintenance of cow sheds, floors and fittings in a thoroughly clean and hygienic condition and by the adoption of rapid and efficient milking, it will not be possible, even with the aid of penicillin, to control the disease. Prevention is better than cure.

THE INFLUENCE OF ROTATION ON THE YIELD AND FLOUR STRENGTH OF WHEAT.

By F. L. SHIER and W. P. CULLINANE.

INTRODUCTION.

CROP rotation experiments have been conducted at the Chapman and Wongan Hills Research Stations since 1929 to obtain data primarily on the effect of rotation on the yield of wheat for grain. The general objectives were to demonstrate the beneficial effect of longer rotations and the inclusion of legumes. In each instance the legume employed was the Western Australian blue lupin (*Lupinus Varius*) although the present tendency in both regions is to use subterranean clover as the renovating pasture species. Although rotation experiments are difficult to conduct and are long term investigations, it was apparent by the early forties that the inclusion of the legume had appreciably improved crop yields. Owing to the ability of these plants to fix atmospheric nitrogen it seemed reasonable to assume that this improvement in yield was due primarily to a build-up in soil nitrogen. This view was supported by data from experiments at these two stations (Teakle and Samuel 1936) in which nitrogenous fertilisers were applied to the wheat crop in addition to superphosphate.

It has long been accepted that environmental conditions can markedly influence the protein (gluten) content of the grain. Of the soil factors at these research stations the nitrogen status is likely to be the most influential in raising the protein level of the grain. The value of wheat for bread making is dependant on the quantity of protein present and on its quality, the latter being largely a varietal characteristic. As normally the wheat grown on the light soils represented by the experimental areas was noted for its indifferent quality for bread making it was decided in 1944 to examine the grain from the several rotations for flour strength. The results of the tests on the 1944 samples were reported by Samuel (1945).

Yield data for the period 1933-1947, together with flour strength determinations for 1944-1947 are presented in this paper.

EXPERIMENTAL.

The rotations at each station comprised:—

(a) Continuous wheat;
(b) fallow, wheat;
(c) stubble, fallow, wheat;
(d) lupins, lupins, fallow, wheat.

The layout was duplicated and was such that two plots of each rotation were sown to wheat each year. The Chapman Research Station is situated 28 miles north of Geraldton near the northern limit of the wheatbelt. The soil on the experimental area was originally timbered with Jam (*Acacia Acuminata*) and is a brown to red brown sandy loam at the surface with rather more clay in the subsoil. The Wongan Hills Research Station is situated approximately 120 miles north-east of Perth. The rotation experiment is located on Wongan sandy loam, a soil type typical of large proportions of the laterite sand plains of Western Australia.

In this experiment 60lbs. of seed per acre was used at Chapman and 45lbs. per acre at Wongan Hills. Superphosphate has been the only fertiliser used and

was applied with each wheat crop. The variety planted varied from year to year and is shown in Appendix 1. In 1947 relatively strong flour varieties (Eureka at Chapman and Charter at Wongan Hills) were used to obtain a greater range of flour strengths under the effects of the various treatments.

Flour quality determinations were made in the Cereal Research Laboratory and the strength factors reported are—(1) Wholemeal fermentation time or Pelshenke time; (2) Farinograph (water absorption and strength figure); and (3) dry gluten, as described by Samuel (loc. cit.).

1. Wholemeal fermentation time or Pelshenke time. The longer the time in minutes the stronger the wheat.

2. Farinograph—
   (a) Water absorption calculated on the basis of 13.5 per cent. moisture in the flour. The water absorption of a flour is not a good measure of strength but is commercially important because the higher the water absorption the greater the amount of bread produced per sack of flour.
   (b) The Farinograph strength figure, the time in minutes from the commencement of mixing until the top of the graph falls below the level of the mid-point of the graph at maximum consistency. The greater the strength figure, the stronger the flour.

3. Dry gluten percentage—Since the amount of wet gluten is normally about three times the amount of dry gluten, only dry gluten contents are reported. The strength of a flour depends on both the quantity and quality of the gluten. All gluten determinations were by hand washing with tap water.

The monthly rainfall figures for the two stations for the period 1944-47 together with the averages since recordings were first commenced are shown in

TABLE I.

RAINFALL (POINTS).

					Growing Period								
	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total.
					CHAPMAN RESEARCH STATION.								
1944	....	.	36	52	250	226	542	203	46	.	1,267	29	42	1,426
1945	. .	29	25	15	283	939	233	381	149	19	2,004	33	27	2,133
1946	4	24	16	102	160	597	852	229	27	3	1,868	193	12	2,219
1947	. .	45	62	143	323	338	321	134	156	365	1,637	19	3	1,909
Average (42 years)	24	37	67	75	236	429	393	264	145	90	1,556	38	26	1,827
					WONGAN HILLS RESEARCH STATION.								
1944	3	. .	21	19	249	131	374	193	40	14	1,001	7	40	1,091
1945	....	41	69	71	165	629	214	416	124	14	1,562	48	30	1,821
1946	....	33	31	201	244	444	447	197	18	2	1,352	106	..	1,713
1947	46	9	44	91	273	324	224	81	77	212	1,191	41	4	1,420
Average (22 years)	35	46	94	92	195	274	260	200	90	72	1,091	43	4	1,445

RESULTS.

A. Yields.—The average yield (two plots) for each year of the experiment (1933-1947) is shown in detail in Appendix 1. The average for the period 1936-47 and for 1944-47 when flour quality determinations were carried out are given in Table 2.

B. Wheat and Flour Quality.—The detailed figures for water absorption, strength, figure, dry gluten and Pelshenke time are set out in Appendix 2 for the four years (1944-47) whilst the averages for this period are shown in Table 2.

TABLE II.

FLOUR AND WHEAT QUALITY (1944–47) AND GRAIN YIELDS (1936–47 AND 1944–47)—AVERAGE FIGURES.

Rotation.	Flour.			Wheat.		
	Farinograph.		Dry Gluten % *	Pel-shenke Time (mins.)	Yield (bus. per acre).	
	Water Absorption %	Strength Figure.			1936–47.	1944–47.
CHAPMAN.						
Continuous wheat	57·4	5·6	8·4	64	7·0	4·3
Fallow, wheat	55·6	3·8	6·9	54	9·1	7·0
Stubble, fallow, wheat	54·7	3·3	6·4	43	10·9	9·0
Two years lupins, fallow, wheat	57·9	5·6	8·9	58	18·3	15·6
WONGAN HILLS.						
Continuous wheat	55·4	5·3	6·9	55	6·6	4·7
Fallow, wheat	56·2	6·1	7·4	66	13·2	14·3
Stubble, fallow, wheat	57·1	6·8	7·5	66	16·5	18·3
Two years lupins, fallow, wheat	58·9	8·8	8·2	69	18·4	19·3

* Dry gluten percentage for the year 1946 is excluded from the Average, *see* Appendix 2.

CHAPMAN.

At Chapman it will be noted that the yield increased as the rotation lengthened. The fallow-wheat rotation gave an increase of 2.1 bushels (30 per cent.) over the continuous wheat plots, whilst the inclusion of the stubble year improved the yield by a further 1.8 bushels per acre, i.e., 56 per cent. over the continuous wheat. However, the inclusion of two years of legume in the rotation has given almost a three-fold increase over the continuous wheat rotation. Over the four years (1944-47) the increased yield of the legume rotation over that of the fallow wheat rotation has amounted to 73, 130, 125 and 170 per cent. respectively, whilst the corresponding increases over the yields of the stubble, fallow, wheat plots were 50, 68, 139 and 49 per cent. The variability in the response of the wheat crop to these rotations can be attributed largely to seasonal variations in the amount of soil nitrogen actually available to the growing crop caused by seasonal variations in the growth of the legume and the intensity of the winter rains. In the case of all treatments except the continuous wheat the cereal was preceded by fallow which would result in much of the soil nitrogen being converted to a readily soluble form very subject to leaching following intense winter rains. There may also be some variation in the response of the different varieties to varying levels of available soil nitrogen.

The legume rotation has quite definitely increased the flour strength over that from the wheat-fallow, and stubble-fallow-wheat rotations. The average figures show an increase in the percentage of protein (dry gluten) in the flour from the legume rotation compared with that from the fallow-wheat and stubble-fallow-wheat. These increases are probably not as consistent as those mentioned previously on yield and also are of lower magnitude but they are none the less

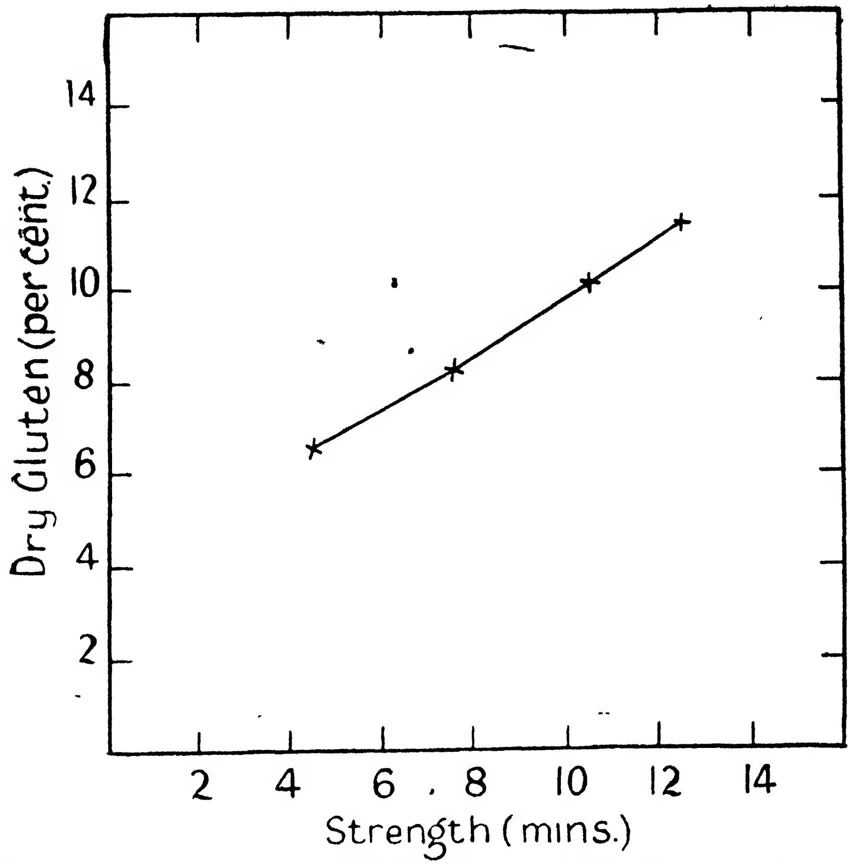


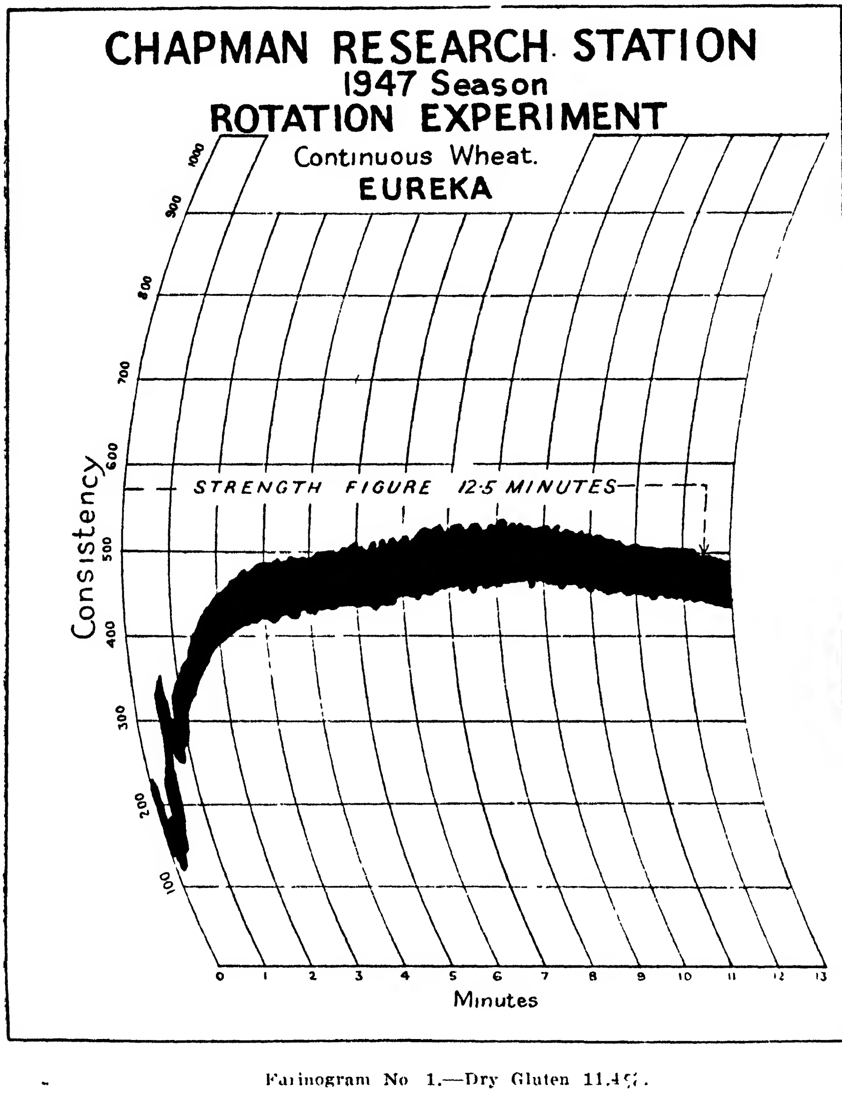
FIG. 1.—Illustrates the relationship between strength and dry gluten (with the same variety).

significant. The increments in gluten content are of economic importance because of their effect on flour strength. This point is perhaps best illustrated by the results from Chapman for 1947 when the variety Eureka was used, a variety which has the inherent capacity to produce a strong flour under suitable conditions. This is illustrated graphically in Fig. 1, whilst the farinograms on which this illustration is based are also included. When the dry gluten per cent. was only 6.6 the strength figure was 4.5, i.e., about equivalent to that for F.A.Q. wheat, but with each increase in gluten the strength figure rose also. When the dry gluten reached 11.4 per cent. the strength figure was 12.5 that is of "premium" strength.

The average results for Farinograph strength figure, water absorption and Pelshenke time demonstrate similar trends in favour of the legume rotation compared with the fallow-wheat and stubble-fallow-wheat rotations.

The continuous wheat plots at Chapman have given which at first sight may appear somewhat anomalous results on wheat yield and flour quality, namely, a low grain yield but high dry gluten, strength and Pelshenke figures, equivalent to those from the legume rotation plots. This result may be explained on the assumption that there was sufficient nitrogen available for protein formation for the very low yielding crop. Another possible explanation is that under

the peculiar conditions of these experiments at Chapman the continuous wheat plots have become infested with weed growth including in some years an appreciable percentage of medics and small clovers.



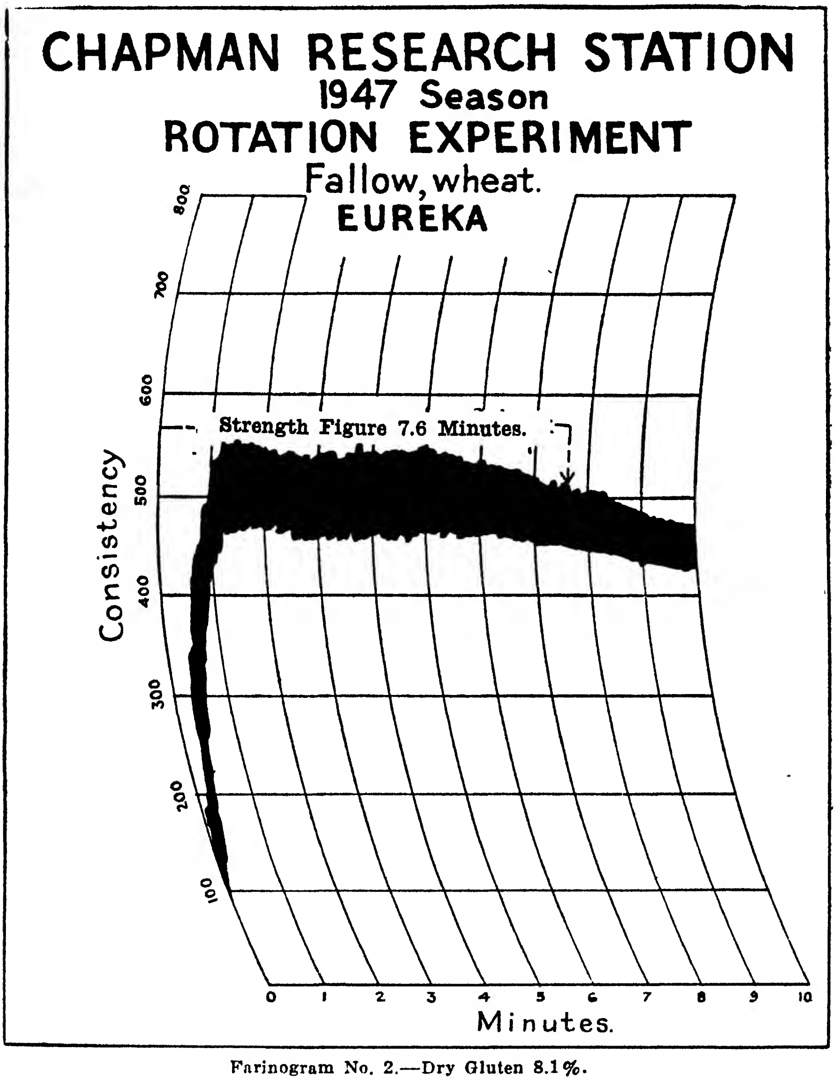
Farinogram No. 1.—Dry Gluten 11.4%.

WONGAN HILLS.

The results from this station differ from those at Chapman in two important respects. Firstly, although the average wheat yields for the treatments show the same general trends as at Chapman, in some years, e.g., 1944 and 1947 the wheat plots of the legume rotation were badly affected by Take-all with consequent markedly reduced yields.

Secondly the continuous wheat rotation consistently gave grain of the lowest protein (dry gluten) content and strength of the four rotations. In contrast to Chapman, medics and other legumes were entirely absent from the

weed growth on the continuous wheat plots. However, the introduction of the legume in the rotation has fairly consistently given marked increases in flour strength due to the increased protein (dry gluten) content.

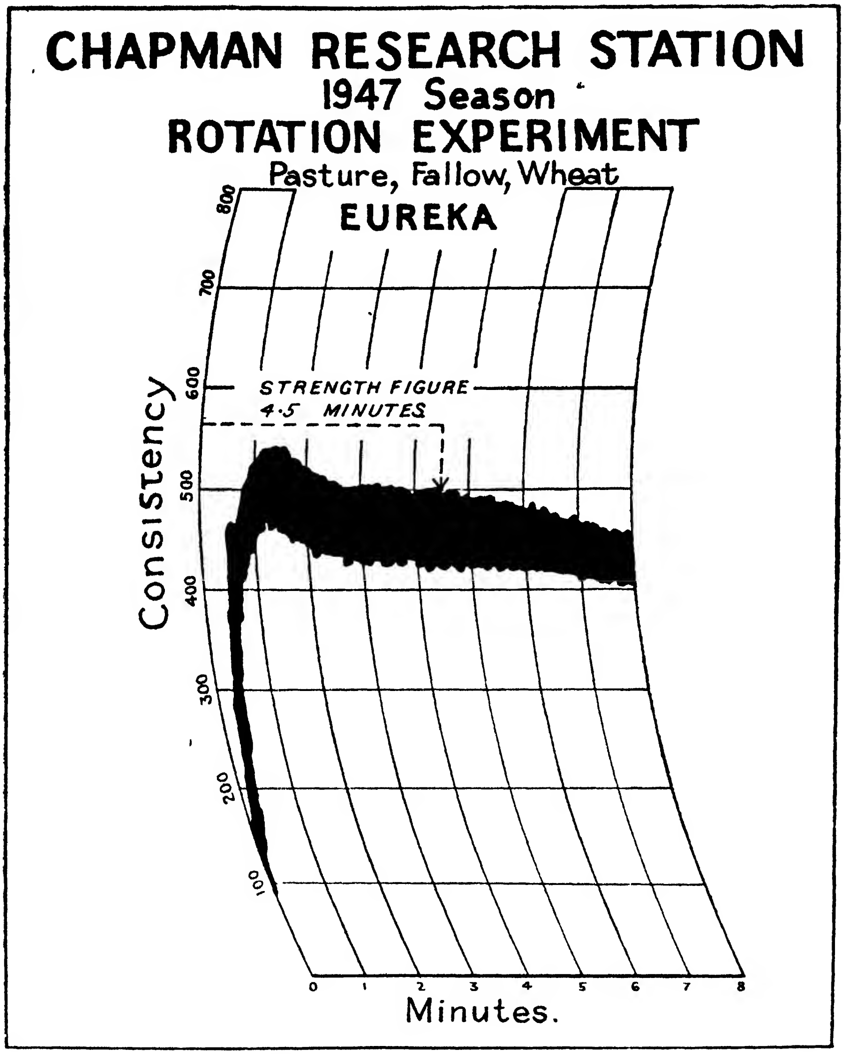


Farinogram No. 2.—Dry Gluten 8.1%.

DISCUSSION.

The wheat farmer is primarily interested in his yields per acre. In recent years there has been increasing evidence of declining wheat yields on the light soils as typified by the experimental areas under review at Chapman and Wongan Hills. The results presented support the contention that these decreasing yields are mainly due to a fairly rapid depletion of available nitrogen in soils which were only poorly supplied in this element initially. The nitrogen status of these soils must be improved before economic wheat yields can be obtained over a period of years. Artificial fertilisers such as sulphate ammonia are too costly and are thus uneconomic for this purpose. The only logical way of improving

these low grade soils and ensuring satisfactory yields is by the incorporation of legumes in the rotation. Such a practice not only ensures more and better grazing for stock but must tend to improve soil fertility with consequent improved grain yields of better quality wheat.

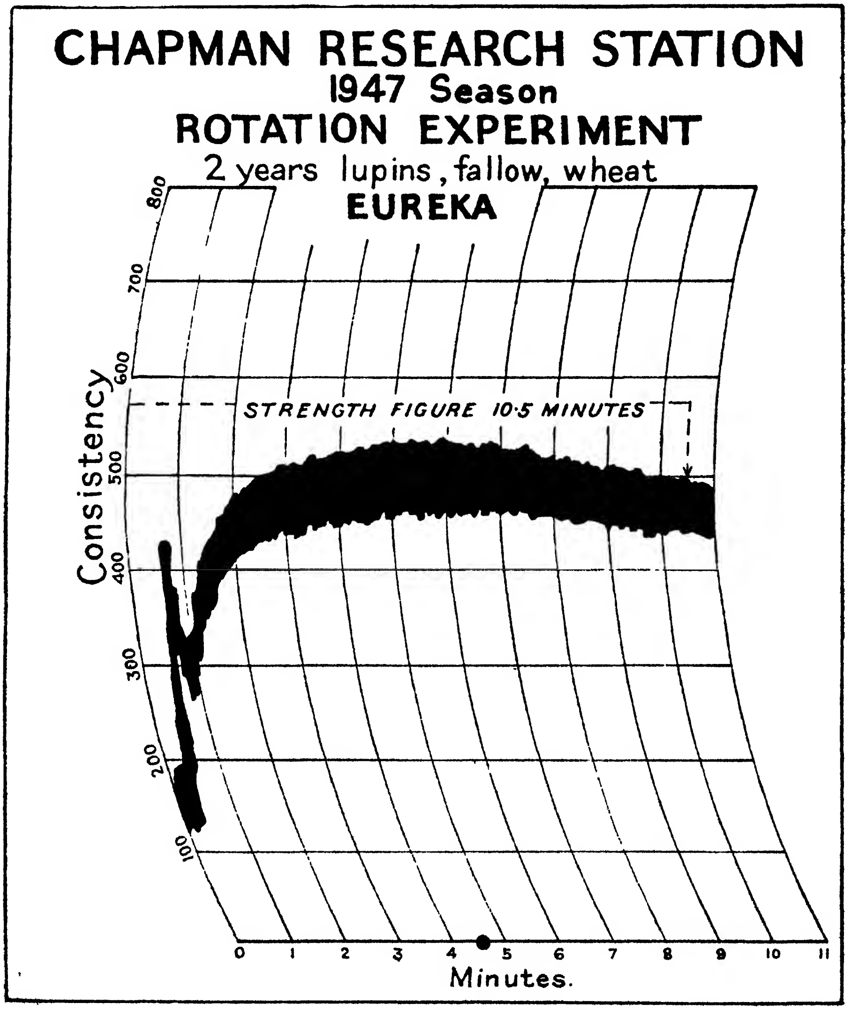


Farinogram No. 3—Dry Gluten 6.6%.

In this regard numerous instances have been observed of the improved and excellent yields on "ploughed in" clover and lupin land. Typical of these are the results reported by Giles (1948) at Wongamine, near Northam. One area was cropped under the ordinary three course rotation, volunteer pasture-fallow-wheat, whilst the other area of similar soil had been sown on "ploughed in" (non-fallow) land following 11 years of sub clover pasture. Samples of the wheat from the two areas were tested for strength and these results together with the yield figures are set out in the table on the following page.

Rotation.	Yield (Bus. per acre).	Farinograph.		Dry Gluten %	Pelshenke Time (mins.)
		Water Absorption	Strength Figure.		
Three Course	12	58·5	3·0	6·0	37
After 11 years clover	27	61·5	5·1	9·0	42

The farmer's more immediate concern regarding his cropping rotation and choice of variety is the yield in bushels per acre but the strength of the resultant wheat has a much wider implication. Frequently criticism has been levelled at the quality of West Australian and Australian wheat for bread making and the cry has been for better varieties. It is suggested that much of the poor quality wheat for bread making may be more the result of low nitrogen status of the soil on which it is grown rather than the variety and conversely the general level of



Farinogram No. 4.—Dry Gluten 10.1%.

the strength of the f.a.q. can be raised by the improvement in soil nitrogen levels following the incorporation of legumes in the rotation. The data presented also clearly indicate that varieties which are capable of producing flour of satisfactory baking quality are unlikely to do so on light and exhausted or run down soils. For a number of years now the wheat breeding policy of the Department of Agriculture has been to produce varieties capable of giving a flour of filler strength, a standard described by Kent-Jones as "one which is of such strength that in a normal baker's grist it requires no help from strong wheats but is not able to carry any weak wheat."

Varieties capable of giving better quality protein may be developed by the plant breeder but for flour of satisfactory strength for bread making it is necessary that protein be present in sufficient quantity to satisfy the requirements of this standard.

The capacity of certain of the recently released varieties such as Charter, Kondut and Wongoondy to produce flour of satisfactory strength on the lighter soils of the wheat belt would appear from the data presented in this paper to be dependent on the crop following some years of a legume pasture such as lupins or subterranean clover. Under such conditions of high soil fertility not only will the yields be satisfactory but the wheat from these improved soils will tend to raise the strength of our f.a.q. It is hoped that in time further varieties will be produced which will have the capacity to give better quality bread making flour than those at present under cultivation whilst at the same time losing nothing in yielding ability or other agronomic characteristics. It is concluded however, that any marked improvement in the strength of this State's f.a.q. wheat is probably more dependent on the development of leguminous based rotations, particularly on the light and medium soils.

SUMMARY.

Experiments conducted at the Chapman and Wongan Hills Research Stations during the period 1933-47 designed primarily to demonstrate the effect of longer rotations and the incorporation of legumes on the yield of wheat are described.

Flour strength determinations on the grain from the several rotations over the four year period 1944-47 are also presented.

The results show that whilst the two-year rotation (fallow, wheat) and the three-year (stubble, fallow, wheat) have improved the yields somewhat, the inclusion of a two-year leguminous pasture period has frequently given two or three-fold increases over that obtained from continuous cropping.

The "strength" of the wheat was quite definitely improved through the use of the legume. When relatively strong flour varieties were used the grain from some of the non legume rotations was little better than f.a.q. strength whereas that from the legume rotation was approaching "premium" quality.

It is suggested that these increases in yield and flour strength are largely the result of an improvement of the nitrogen status of the soil following the legume pasture.

The significance of the results are discussed and it is concluded that firstly the development of leguminous based rotations particularly for the light and medium soils of the wheatbelt is essential for the maintenance of a sound agriculture and secondly such rotations are more likely to improve the strength of the State's f.a.q. wheat than improved varieties.

REFERENCES.

Giles, K. (1948): private communication. W.A. 22:294.
Samuel, L. W. (1945): Jn. Dept. Agric.
Teakle, L. J. H. and Samuel, L. W. (1936): Ibid. 13:74.

APPENDIX 1.

Rotation Experiment 1933-1947. Yield in bushels per acre.

CHAPMAN

Rotation / Variety.	1933 Bencub-bin	1934 Bencub-bin	1935 Nabawa	1936 Nabawa	1937 Nabawa	1938 Nabawa	1939 Nabawa	1940 Nabawa	1941 Nabawa	1942 Bungulla	1943 Bungulla	1944 Nabawa	1945 Nabawa	1946 Bungulla	1947 Eureka
Continuous-Wheat	16·3	Crop badly affected by rust	3·6	13·8	7 7	6·2	13·8	6·1	6·4	4·3	8·5	5·3	2·9	4·5	4·6
Fallow-Wheat	22·8		19 0	11 6	14 9	11 8	10 9	9·9	10·5	5·7	5·5	6·7	5·5	8·5	7·1
Stubble—Fallow-Wheat	20·4		22·2	13·8	17·2	14·4	11·7	13·3	8·3	6·9	9·8	7·7	7·5	8·0	12·8
Two years Lupins—Fallow-Wheat	18·8		24·2	20 2	31·7	19·9	16·9	15·3	8·7	14·1	30 9	11·6	12·6	19·1	19·1

WONGAN HILLS

Rotation / Variety.	Tot-adgin	Tot-adgin	Tot-adgin	Tot-adgin	Tot-adgin	Tot-adgin	Tot-adgin	Tot-adgin	Merre-din	Mer-redin	Mer-redin	Mer-redin	Koorda	Koorda	Charter
Continuous Wheat	21·7	5·8	13·4	7·9	Crop des-troyed by hail	13·5	6·9	9·6	12·7	2·2	7·1	5·1	2·1	3·9	7·8
Fallow-Wheat	21·6	14·6	17·2	15·6		13·1	5·9	13·0	16·5	14·7	22·5	16·2	14·1	9·5	17·2
Stubble—Fallow-Wheat	21·8	15·1	21·1	17·1		17·1	10·9	13·1	16·3	24·2	25·5	22·1	17·6	14·0	19·6
Two years Lupins—Fallow-Wheat	21·7	13·1	20·9	19·2		16·4	9·3	12·8	26·3	25·6	34·7	12·7*	29·1	19·3	16·3*

* Affected by Take-all.

APPENDIX 2.

Wheat Strength (average of two samples). Rotation Experiment, 1944-1947.

CHAPMAN

Rotation.	FLOUR (Milled experimentally on a Brabender stone mill) Farinograph Water Absorption.				Strength Figure				Dry Gluten per cent.				WHEAT. Pelshenke time (minutes).			
	1944	1945	1946	1947	1944	1945	1946	1947	1944	1945	1946	1947	1944	1945	1946	1947
Continuous Wheat	54 8	56 ·8	53 ·4	64 ·7	3 ·8	2 ·8	3 ·1	12 ·5	7 ·4	6 ·4	6 0	11 ·4	32	43	52	130
Fallow-Wheat .	54 ·8	55 ·8	51 ·8	59 ·9	3 ·6	2 ·0	1 ·8	7 ·6	7 ·2	5 ·4	(a)	8 ·1	32	38	48	60
Stubble—Fallow-Wheat	54 ·5	54 ·8	50 ·6	59 ·0	4 ·0	2 ·5	2 ·0	4 ·5	7 ·0	5 ·6	(a)	6 ·6	32	37	48	53
Two years Lupins-Fallow-Wheat	58 ·0	56 ·9	52 ·1	64 ·7	6 ·4	2 ·8	2 8	10 ·5	10 ·1	6 ·4	6 ·1(b)	10 ·1	41	40	59	93

(a) No gluten obtainable ; dispersed during washing. (b) Gluten obtainable from only one sample.

WONGAN HILLS

Rotation.	Water Absorption 1944	1945	1946	1947	Strength Figure 1944	1945	1946	1947	Dry Gluten 1944	1945	1946	1947	Pelshenke 1944	1945	1946	1947
Continuous Wheat .	52 ·2	55 ·4	52 ·9	61 ·1	2 0	3 ·4	6 ·7	9 ·0	5 ·4	7 ·1	7 ·1	8 ·1	34	46	63	78
Fallow-Wheat	53 ·8	55 ·6	53 ·1	62 ·3	3 ·6	4 ·1	6 ·4	10 ·2	6 ·3	7 ·3	7 ·2	9 ·0	42	45	64	114
Stubble—Fallow-Wheat	55 ·7	55 ·4	53 ·3	63 ·8	5 ·3	4 ·2	6 ·8	10 ·9	7 ·0	7 ·1	7 ·4	8 ·5	47	44	66	109
Two years Lupins-Fallow-Wheat	56 ·2	56 ·8	53 ·4	69 ·0	5 ·6	4 ·6	8 ·1	16 ·7	8 ·2	7 6	7 ·6	9 ·5	50	42	74	102

PHOSPHORUS SUPPLEMENTS FOR DAIRY COWS.

L. C. SNOOK, Animal Nutrition Officer.

TO ensure continued high milk production and good health it is essential that dairy cows should receive adequate supplies of phosphorus in their food. For many months of the year typical West Australian pastures do not contain sufficient of this essential phosphorus. If the farmer fails to provide the correct form of mineral supplement the cows cease to produce milk to full capacity, or they deplete their bodily reserves. In either case the farmer suffers financial loss.

Before the war the need by the dairy cow for additional phosphorus received continual emphasis, and the provision of phosphatic licks was accepted as part of good farming practice. But during 1940-46 the feeding of bonemeal and di-calcic phosphate went right out of fashion, firstly because these materials could not be purchased, and subsequently because there was no obvious evidence that the cows suffered when these licks were withdrawn. Farmers are also topdressing their pastures with increasingly heavy annual applications of superphosphate, and it is not surprising that the resultant high quality mixed pastures should be expected to contain all the phosphorus needed by dairy cows. Such is not the case, however.

Recent studies have shown very clearly that many cows in our South-Western dairying districts are suffering from a real or incipient phosphorus deficiency. This must certainly affect milk production, and may also reduce resistance to disease and be one explanation of seasonal sterility. It seems that good milking cows while on winter pastures cannot make good the losses in phosphate suffered during the summer, when dry feed relatively deficient in phosphorus forms the bulk of the diet. It is well known, of course, that, as pasture plants mature, the phosphorus content falls, but very few realise just how serious this fall can be to the milking cow. Even good quality meadow hay cut from excellent South-West mixed pastures does not contain enough phosphorus. The present indications are that not only should dairy stock *of all types* receive phosphatic supplements during the summer months but that supplements should be fed to milking cows during the winter as well, as it is during this time that lactation imposes the maximum drain on the mineral reserves.

RECOMMENDED PHOSPHATIC SUPPLEMENTS.

Sterilised Bonemeal.—On general principles this seems the best supplement to feed. Bonemeal supplies not only phosphate but all the other ingredients which have been used to build up healthy bone.

Unfortunately supplies of bonemeal are limited and other sources of phosphate have to be exploited.

Steamed bone flour.—This is a by-product of gelatine manufacture and is a cheap, convenient source of phosphorus. Being an odourless powder, it is easily mixed with other materials without affecting the palatability.

Di-calcic phosphate.—This is prepared from phosphatic rock and sold in powdered form as a source of readily available phosphorous. In most cases the dairy farmer would be advised to buy the "concentrate," rather than the "lick" which is already mixed with salt, as the former is cheaper per unit of phosphorus.

It should be remembered that Denmark Lick or Denmark Substitute Lick does NOT supply phosphate. These licks are prepared to supply cobalt and copper.

METHOD OF SUPPLYING PHOSPHATE.

In the bails.—Where cows are bail fed it is a simple matter to mix the phosphatic supplement with the other food. One can then be certain that every cow receives the measured amount. On most farms two ounces of bonemeal or di-calcic concentrate per head per day should meet all requirements but high-producing cows may benefit from as much as four ounces per day. During the summer months, if no green picking is available, it is wise to err on the generous side.

Complaints will be made that cows will not eat bonemeal, or even enter the bails when this admittedly obvious supplement is mixed with the usual food. It is important to let the cows become accustomed to the smell of bonemeal before using any quantity. Place a mixture of salt and bonemeal (and even bran) in boxes in the yards, or near the watering places, until the cows have commenced to eat the new supplement. Bonemeal can then be gradually mixed with the food in the bails. Despite statements to the contrary, no difficulty should be experienced in getting cows to consume bonemeal so long as commonsense precautions are taken.

Steamed bone flour and di-calcic phosphate have little smell or taste and should present no difficulty in feeding.

In the field.—Phosphatic supplements in the form of salt "licks" should be available *to all dairy stock* in the field. These licks are prepared by mixing phosphate with coarse salt and placing the mixture in boxes which should be set up under some sort of shelter to keep out the rain.

A suitable salt lick can be made up as follows:—

Coarse salt	2 parts
Bonemeal or di-calcic concentrate	1 part

In areas where copper and/or cobalt deficiency is at all likely, Denmark lick should be supplied as before, or the additional mineral supplements can be incorporated in the phosphate mixture as follows:—

To each 100 lb. of salt add:—

Powdered bluestone or copper sulphate	4 oz.
Cobalt sulphate	1 oz.

In mixing bluestone or cobalt sulphate with the salt it may be more convenient to dissolve this in hot water and sprinkle over the salt before mixing. Care should always be taken to use a glass or china vessel when dissolving bluestone in water, as this solution rapidly corrodes metal containers.

Licks of the above type will keep indefinitely while dry so they can be prepared in bulk lots. The use of mineral di-calcic phosphate may be an advantage in this regard, as bonemeal will not keep so well if it becomes damp.

DAIRY HERD IMPROVEMENT SCHEME.

GRADE HERD RECORDING, 1947-48.

M. Cullity, Superintendent of Dairying.

AS stated in the report on Grade Herd Recording for the season 1946-47 (this Journal December, 1947), the testing of commercial herds ceased in 1942 owing to the need for men for the Defence Forces and urgent public works.

The scheme was recommenced in 1946 with 21 units.

Experiences during the year showed that the keenness of farmers was sustained and with the opening of the season in 1947 three additional units were commenced.

Seasonal conditions were favourable, with the result that abundance of pasture feed was available, consequently stock remained in excellent condition throughout the year and the yield per cow showed a substantial rise. Although some improvement in yield might reasonably be expected from the data provided by the scheme, it would be too optimistic to expect that the actual rise from 181 to 213 lb. of butterfat per cow was solely responsible to this. There is no doubt that the better seasonal conditions providing a greater abundance of feed was the prime cause. There is evidence however that many factors of management, including designed efforts on the part of the farmer to improve feeding, contributed to the rise.

In this report, in addition to setting out details regarding the performance of the various herds and units, some indication will be given of the factors which have contributed, and also an outline of various projects which have been, or will be, commenced shortly, in order to supply additional data to dairy farmers to assist them in the more profitable management of their herds.

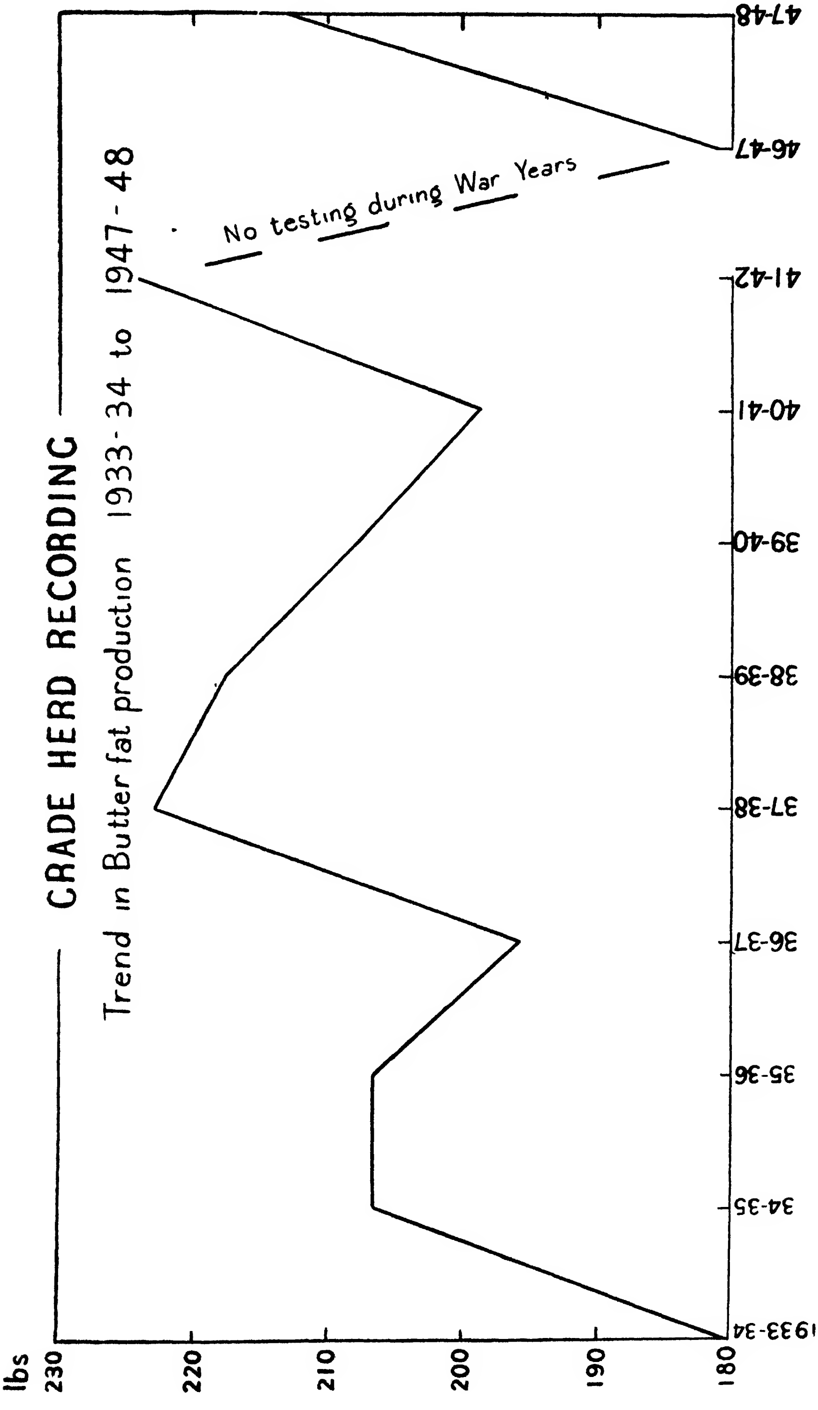
Graph No. 1 indicates the trend in average yields each year since the inauguration of the scheme in 1933-34, and while the upward movement of yields from year to year is not regular, a definite trend may be seen.

It is interesting that the yield in 1946-47, (the first post-war year of testing), approximated that of 1933-34 only. However, this performance is better than that in the earlier year owing to the fact that average cow production fell seriously during the war period.

The following table shows the degree to which this occurred.

Table 1.

			Average per cow.	
Year.	Milk (gals.)	No. of Cows.	Milk (gals.)	Butterfat. (lb.)
1938–39	45,562,000	119,814	380·2	152·1
1939–40	44,745,000	121,852	367·2	146·8
1940–41	44,801,000	124,370	360·2	144·1
1941–42	49,050,000	128,664	381·2	152·5
1942–43	46,346,000	129,763	357·1	142·8
1943–44	43,156,000	138,100	312·5	125·0
1944–45	40,416,000	136,499	296·2	118·5
1945–46	43,004,000	133,502	322·1	128·8
1946–47	45,596,000	131,711	346·2	138·5
1947–48	51,239,000	132,305	387·3	154·9



Graph No. 1.—Trend in average yields each year since the inauguration of the scheme in 1933-34.

There is no doubt that the major cause of the decline in the average yield per cow during the war years was the reduction in the quantity of feed available for each cow as the result of the reduced application of superphosphate to pastures. The depressing effect of this was gradual during the operation of the rationing scheme, but the useful effect of the applications of superphosphate was very quickly demonstrated when adequate supplies again became available.

Other factors, such as the shortage of labour, materials, purchased fodders, also contributed but probably to a minor extent. In this period also, farmers did not have the convenience of having their herds tested and so were not able to cull on the basis of actual knowledge of performance.

The average yields for each year since the commencement of the scheme are shown in table 2.

TABLE 2.
AVERAGE PRODUCTION PER COW 1934–48.

Year.	No. of Cows.	Milk (gals.)	Test (per cent.)	Butterfat (lb.)
1933–34	4,308	415	4·35	180·60
1937–38	10,033	486	4·59	223·10
1938–39	12,368	487	4·48	218·70
1939–40	11,479	462	4·51	208·30
1940–41	9,609	447	4·45	199·00
1941–42	7,081	496	4·52	224·02
	*5,695	502	4·61	231·78
1946–47	11,944	420	4·36	181·00
1947–48	12,395	478	4·46	213·30

* Excludes four units tested for from six to seven months only.

Heifers intended for the soldier settlement scheme, SIDCUP near Mt. Barker.

It will be noted from this that the total number of cows under test was higher than in any previous year.

In all 460 herds were tested.

The value of the scheme is acknowledged throughout the dairying districts and there were a large number of farmers who wished to have their herds included but it proved impossible to make satisfactory arrangements. It is likely that in the coming year further extension of the scheme will take place.

Details of the performance in each unit are shown in table 3, the units being arranged in order of merit.

TABLE 3.

PRODUCTION PER COW IN EACH UNIT.

(Units listed in order of Merit)

	Unit Letter	Unit.	Number of Herds.	Number of Cows.	Percentage of Heifers*	Milk Average lb.	Test	Butterfat Average lb.	
								1947–8	1946–7
							%		
1	C	Harvey ...	17	665	38	5,479	4·65	255·00	192·0
2	H	Sth Cowaramup	16	341	35	5,839	4·30	252·76	194·9
3	G	Nth. Cowaramup	24	535	34	5,154	4·74	244·20	228·0
4	B	Waroona ...	18	520	32	5,385	4·40	238·69	198·0
5	J	Rosa Brook	24	571	33	4,965	4·60	228·75	201·[illegible]
6	A	Pinjarra ...	17	569	33	5,163	4·40	227·27	184·0
7	S	Mt. Barker ...	21	589	14	5,084	4·39	223·81	158·5
8	T	Albany ...	19	435	34	4,879	4·53	220·70	166·0
9	L	Donnybrook	19	476	36	4,476	4·89	219·00	193·0
10	W	Denmark ...	19	365	30	4,858	4·45	216·35	191·6
11	M	Balingup ...	23	665	31	4,735	4·50	213·34	181·5
12	N	Bridgetown...	21	570	7	4,698	4·53	213·04	167·5
13	P	Pemberton ...	23	459	4	4,672	4·50	210·65	148·4
14	D	Brunswick ...	13	466	21	4,605	4·57	210·63	181·0
15	E	Ruabon ...	16	567	34	4,956	4·10	207·16	201·6
16	R	Wilga - Noggerup	21	499	43	4,526	4·50	205·16	162·0
17	Y	Scotsdale ...	17	377	52	4,351	4·62	201·43	...
18	U	Nannup ...	18	536	20	4,641	4·20	197·70	170·0
19	I	Margaret River	22	566	33	4,600	4·20	196·08	187·4
20	K	Forest Grove	18	438	5	4,300	4·60	195·50	163·3
21	O	Manjimup ...	23	593	13	4,445	4·34	193·30	167·8
22	F	Metricup ...	18	493	37	4,624	4·12	190·63	216·7
23	V	Vasse-Jindong	19	547	26	4,367	4·30	189·10	...
24	X	Northcliffe ...	19	553	19	4,161	4·26	177·00	...

* Including two and three year olds.

It will be seen that the leading unit was that at Harvey, where 17 herds with 665 cows gave an average yield of 5,479 lb. milk and 255 lb. of butterfat. Harvey is an irrigation area, where a number of the farmers have irrigated pastures. The performances in other districts in non-irrigable areas, such as Cowaramup North and South, with yields of 5,839 lb. milk, 252.17 lb. butterfat and 5,154 lb. milk, 244.2 lb. butterfat respectively, show that dairying can be adjusted to meet differences in conditions. Although the Harvey area may have

the advantage of irrigated pasture, several of the herds supply milk for the metropolitan trade and therefore calving occurs throughout the year. In the non-irrigable areas where milk is not sold for liquid consumption, calving can be arranged to allow the greater part of lactation to be in the winter and spring grazing periods.

A most pleasing feature of the Harvey average, however, is the improvement from that of the previous year when the yield was 4,446 lb. milk and 192.0 lb. butterfat. South Cowaramup also showed a substantial improvement from 4,792 lb milk, 194.9 lb. butterfat.

One difficulty, in interpreting from the unit figures the effectiveness of herd recording in increasing yields, is due to the failure of some farmers to maintain their herds under test continuously. It has been shown elsewhere that regularity in testing over a period of years does mean a considerable advantage by way of higher yields.

Reference was made in last year's report to the case of Mr. O. Foan of Donnybrook, who has had his herd under test each year since 1933. In his first year of testing his herd was twelfth in his unit, in the following year it was ninth, then third, and each year since 1936 it has been the leading herd. During 1946-47 24 cows averaged 334 lb. butterfat, while in 1947-48 the average for 20 cows was 380 lb.

In table 4 a comparison is shown of the herds grouped according to production for each year.

TABLE 4.

HERDS GROUPED ACCORDING TO PRODUCTION.

Butterfat per Head (lb.)

Year.	350–400	300–350	250–300	200–250	150–200	100–150	Under 100
	%	%	%	%	%	%	%
1933–34	...	1·3	3·9	20·3	53·6	18·3	2·6
1939–40	...	3·2	18·5	34·6	32·9	9·7	1·1
1940–41	...	1·5	13·9	31·8	39·4	12·7	·8
1941–42	1·6	8·2	21·9	42·1	21·5	4·7	...
1946–47	...	1·2	7·9	25·2	39·9	22·4	3·4
1947–48	·6	3·9	18·1	38·8	27·6	10·2	·8

In 1933-34, 74.5 per cent. of the herds produced less than 200 lb. butterfat; in 1936-37, 65.7 per cent.; while in the year under review the percentage fell to 38.6.

In 1933-34, 5.2 per cent. of the herds produced over 300 lb. butterfat; for 1946-47, 9.1 per cent. achieved this figure, and for 1947-48 the percentage rose to 22.6.

While these figures show that some improvement has been achieved, they also indicate that far too many herds are yet below 200 lb. butterfat, which figure might be taken as the minimum for a profitable herd. On the other hand,

while the 22.6 per cent. which were over 300 lb. is a substantial improvement on the previous year, it is clear that the great bulk of herds have ample margin for improvement.

In table 5, all cows are grouped according to their production of butterfat. The figures are shown separately for mature cows and for heifers.

TABLE 5.

COWS GROUPED ACCORDING TO AGE AND PRODUCTION

(Cows Tested less than 90 days excluded)

Groups according to Butterfat production (lb.)

Year.	Age.	Over 600	500–600	400–500	300–400	200–300	150–200	100–150	Under 100	Total Cows.
		%	%	%	%	%	%	%	%	
1942 ...	Mat.	0·02	0·3	2·4	21·8	46·4	17·4	8·7	3·0	4,287
1947 ...	"	...	0·07	0·68	7·97	35·16	26·37	20·13	9·62	8,711
1948 ...	"	0·01	0·1	1·85	14·84	42·11	21·21	13·67	6·21	8,999
1942 ...	Heifer	...	0·05	0·2	5·8	36·8	27·5	20·2	9·4	1,978
1947 ...	"	...	...	0·1	3·2	25·5	29·4	25·8	16·0	3,232
1948 ...	"	...	0·05	0·21	7·14	36·42	26·58	19·16	10·44	3,396

Here again it will be seen that while there has been a considerable improvement on last year, too large a number of cows are unprofitable producers and therefore should be culled.

Culling.

Previously the greatest emphasis in discussing herd-recording and the use of data was on the question of culling and breeding. The degree to which the farmer will use the data for the purpose of culling must remain largely a matter for his own initiative, although provision is in the rules that where a cow fails to produce 150 lb. butterfat in two succeeding lactations, she shall be culled.

In view of the probability that in the small herds of Western Australia, the least profitable output per cow is in the region of 200 lb. butterfat, consideration should be given to culling animals which do not reach this figure. As will be shown later, there is evidence that culling from herds is not as heavy as appears desirable. Reports from recorders, however, suggest that many farmers have refrained from selling any stock until the year's testing has been completed.

Month of Calving.

In the present scheme, while the importance of culling continues to be recognised, an effort has been made to bring into prominence the part that various aspects of management play in affecting yields. In this regard the data presented over the past several years regarding the influence of the month of

calving on production, is extremely valuable. This information has now been collected over nine years and is based on 59,718 lactations. Details are given in table 6, and graph No. 2.

TABLE 6.

PRODUCTION OF COWS ACCORDING TO MONTH OF CALVING.

Month.	1947–48		7 years 1936–42 and 2 years 1946–48.	
	No. of Lactations.	Average Butterfat.	No. of Lactations.	Average Butterfat.
		lb.		lb.
January	108	208·6	797	190·0
February	142	219·7	1,343	201·5
March	593	239·5	4,287	224·4
April	1,693	257·5	9,917	239·7
May	1,746	240·7	10,799	236·7
June	1,870	228·1	10,734	232·2
July	1,566	215·6	10,148	224·5
August	977	188·4	5,935	196·8
September	492	185·1	2,909	178·3
October	273	175·8	1,590	169·6
November	77	209·1	732	188·0
December	62	220·6	527	182·1
Totals	9,599	...	59,718	...

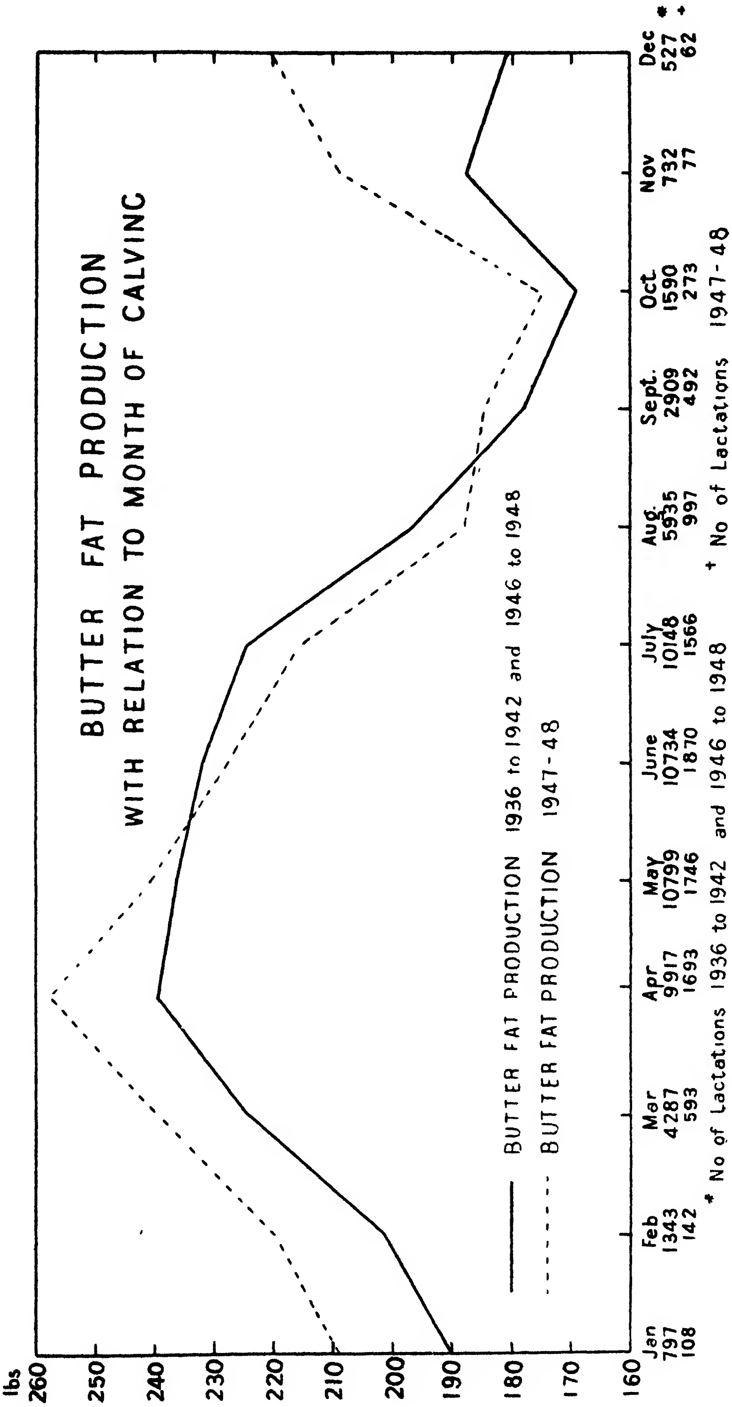
It is apparent from a perusal of this data that those cows which calve during the months March, April, May, June and July are most likely to show higher yields than those which calve in any other month. Some variation from the graph may be found in individual districts, but a study of these shows that the difference is not as great as might be expected. For general purposes the graph should be taken as an indication of the position for the whole of the State, other than in areas from which supplies of milk for the metropolitan area are drawn and in which farmers endeavour to maintain a high level of production during the summer months. This frequently is achieved by the use of purchased concentrates with or without the basis of irrigated pasture.

The number of cows which calved during the optimum period was 78 per cent. From experience during the past few years it appears to be very difficult for farmers to organise for a higher proportion of the cows to calve in this period and this is probably related to obstacles provided by disease in causing temporary or partial sterility.

In an endeavour to ensure that a greater number of cows calve at the right time, arrangements should be made to treat each cow after calving so that the genital passages will remain in a healthy condition. Adequate control of the bull is also desirable.

273-Day Average.

A study of table 7 in conjunction with the foregoing data regarding the influence of the month of calving is also of value. An endeavour is made to show that those cows which have remained in milk for a full 273-day period have produced far more than the average for the whole of the scheme.


BUTTER FAT PRODUCTION
WITH RELATION TO MONTH OF CALVINC
BUTTER FAT PRODUCTION 1936 to 1942 and 1946 to 1948
BUTTER FAT PRODUCTION 1947-48
lbs
260
250
240
230
220
210
200
190
180
170
160
Jan 797 108
Feb 1343 142
Mar 4287 593
Apr 9917 1693
May 10799 1746
June 10734 1870
July 10148 1566
Aug. 5935 997
Sept. 2909 492
Oct. 1590 273
Nov 732 77
Dec 527 * 62 +
* No of Lactations 1936 to 1942 and 1946 to 1948
+ No of Lactations 1947-48

Graph No 3.

TABLE 7.

COWS COMPLETING LACTATION.

	Unit.	Percentage of Cows Completing Lactation. *	Cows Completing 273 days		Unit Butterfat Average. (lb.)
			Percentage.	Butterfat Average. (lb.)	
C	Harvey	74	36	320·52	255·00
R	Wilga	89	10	309·07	205·16
A	Pinjarra	86	27	308·32	227·27
N	Bridgetown	...	12	302·46	213·04
H	Cowaramup, South	84	48	299·20	252·76
L	Donnybrook	88	22	296·66	219·00
G	Cowaramup, North	80	40	292·74	244·20
M	Balingup	95	23	289·80	213·34
S	Mt. Barker...	90	26	288·83	223·81
D	Brunswick	78	14	285·56	210·63
V	Vasse-Jindong	58	13	282·42	189·10
K	Forest Grove	38	12	277·17	195·50
J	Rosa Brook	74	32	274·30	228·75
T	Albany	72	38	271·13	220·70
I	Margaret River	50	32	270·05	196·08
W	Denmark	50	42	267·92	216·35
U	Nannup	86	14	266·17	197·70
B	Waroona	89	46	265·79	238·69
P	Pemberton	92	27	261·61	210·65
E	Ruabon	84	22	259·72	207·16
O	Manjimup	84	15	257·40	193·30
Y	Scotsdale	78	33	255·49	201·43
F	Metricup	57	27	248·28	190·63
X	Northcliffe	68	22	235·69	177·00
	Averages	76	26	279·62	213·3

* i.e., 273 days or drying off naturally in a lesser period.
Average Butterfat of Cows not completing full 273 days :—188·60.

It will be noted that the data is given for each unit and that figures are also given showing the percentage of cows completing lactation as distinct from those which have completed a full 273 days. In the former case the cows which complete 273 days and those which have dried off in a lesser period, are included

For the whole of the scheme 76 per cent. of the cows completed lactation but only 26 per cent. were in milk for 273 days. These averaged 279.6 lb. butterfat compared to the average for all units of 213.3 lb. This, however does not give a complete picture. When the 26 per cent. which completed their 273 days are separated from the 76 per cent. completing lactation—leaving the 50 per cent. which completed lactation in a lesser period than 273 days—it is found that the average for the latter is 188.6 lb. only. In other words, the cows that completed the full period produced an average of 91 lb. of butterfat higher than those which dried off in a lesser period. It is contended that calving in the optimum period mentioned earlier gives a greater prospect of keeping cows in milk over a long lactation period.

Herd Wastage.

As another means of assisting dairy farmers indirectly to achieve higher yields, data has been collected regarding the causes of herd wastage. The first attempt to do this was in a survey of dairying in the Brunswick unit in 1940. An effort was made to collect information during the last pre-war testing period 1941-42, but unfortunately the data was not complete. The information obtained during the past season is shown in table 8.

TABLE 8.

HERD WASTAGE.

Unit.	Unit Letter	No. of Cows in Unit. "A" Class.	"B" Class.	Total Cows.	Total Disposals Wastage, Etc.	Sold for Dairying Purposes.	A Low Production.	B Disease. Udder Troubles Mammitis, etc.	C Abortion and Sterility.	D T.B.	E Other Diseases.	F Other Causes. Accident or Injury.	G Old Age.	H Other Causes.	I Sundry Deaths.
Pinjarra	A	593	46	639	74	4	53	5	...	...	3	3	...	6	...
Waroona	B	560	4	564	90	16	43	18	1	...	2	2	2	6	...
Harvey	C	692	...	692	44	1	36	2	...	...	...	...	1	2	2
Brunswick	D	475	1	476	29	4	12	1	3	...	...	...	8	...	1
Ruabon	E	583	6	589	60	31	26	...	...	...	1	1	...	...	1
Metricup	F	521	...	521	55	4	35	7	...	2	...	2	2	...	3
Nth. Cowaramup ...	G	544	65	609	58	6	39	9	...	2	...	...	...	...	2
Sth. Cowaramup ...	H	368	5	373	32	...	28	3	1	...	...	...	...	...	...
Margaret River ...	I	600	...	600	40	...	32	4	...	...	...	1	1	...	2
Rosa Brook ...	J	609	15	624	45	1	30	5	7	...	...	1	...	1	...
Donnybrook ...	L	504	10	514	44	16	24	...	...	...	1	1	...	...	2
Balingup	M	680	...	680	29	...	21	2	...	...	...	2	...	3	1
Bridgetown	N	578	...	578	29	1	12	12	...	...	1	...	2	1	...
Manjimup	O	609	...	609	26	...	19	4	...	...	...	...	2	1	...
Pemberton	P	461	...	461	12	...	5	...	3	...	...	1	...	3	...
Wilga	R	558	7	565	131	22	82	18	...	...	...	3	1	...	5
Mt. Barker	S	591	...	591	147	5	83	36	5	3	1	...	8	5	1
Albany	T	452	20	472	70	1	37	8	...	...	...	5	14	4	1
Nannup	U	622	10	632	12	1	10	...	...	...	...	1	...	...	...
Vasse-Jindong ...	V	622	...	622	15	...	12	...	...	...	...	...	1	1	1
Denmark	W	384	30	414	31	...	15	3	8	...	...	1	3	1	...
Northcliffe	X	575	7	582	30	3	20	3	...	...	...	...	2	1	1
Scotsdale	Y	393	...	393	9	...	7	...	...	...	...	1	...	...	1
Totals ...	...	12574	226	12800	1112	116	681	140	28	7	9	25	47	35	24
Percentages ...	...	...	...	...	8·68	·91	5·32	1·09	·22	·05	·07	·19	·37	·27	·19

No returns available for Forest Grove Unit.

It would appear from the information obtained, that either farmers are not culling their herds and are not suffering great losses from disease or else complete data is not being given to the Herd Recorders.

In the survey of the Brunswick Unit referred to above it was shown that the average wastage was 16.7 per cent. In the herd recording survey for 1946-47 it was 12.9 per cent., while in the year just completed it has fallen to 8.68 per cent. This suggests, if the figures were accurate, that the average working life of a cow is 12 years. This obviously is not so. An effort is being made during the current year to ensure that full and accurate information is collected.

The information gathered is intended to be used as a means of indicating to the Veterinary Service, districts where an unusual amount of difficulty, or any particular disease is occurring, with a view to concentrating attention on assisting the farmers.

Proving Bulls.

The influence of breeding upon the future quality of the herds must always remain a most important aspect for the consideration of dairy farmers. It has always been accepted that no general improvement can be achieved in inherent capacity for production unless heifers from the best cows, sired by good bulls, are retained for replacement of wastage in the herds. It has been proved, however, that this method alone in the average herd is a much slower means of lifting quality than is generally recognised. This is due to the fact that all the better-than-average cows in a herd do not consistently produce heifer calves. Further, some of the heifers that are actually born from the better cows do not survive.

Under Western Australian conditions the size of the herds is gradually increasing and, therefore, a greater number of heifers is retained than would be needed purely to replace normal wastage. Consequently, each year a number of heifers from below-average cows must be kept. It is obvious, therefore, that unless good bulls are used the rate of improvement may be very slow.

Emphasis in the past has been on the use of standard bulls—that is, purebred bulls from cows which under production recording have yielded more than the standard set at the particular age of testing.

Study of dairy cattle breeding and husbandry in recent years has indicated, however, that while in the absence of more information this method is sound, the only really reliable method of selecting a bull is to procure one which already has sired daughters all of whom are consistent in respect of high yields.

In an endeavour to provide farmers with information regarding the performance of bulls, both in purebred and grade herds, data is published each year in the respective reports showing the performance of the bulls which have been in use. Accordingly in this report, Table 9 shows details of the yield of all daughters of the various bulls used in grade herds during the past season. In this table only those animals which have had six or more daughters in production have been included. For the first time the yields are shown classified according to the age of the cows at calving.

TABLE 9.

BULLS WITH SIX OR MORE DAUGHTERS COMPLETING LACTATION.

Bull.	Breed.	Daughters.										Unit.	Owner.	Age of Bull.
		2 Years Old.		3 Years Old.		4 Years Old.		Mature.		Total.				
		No.	Butter-fat Average.	No.	Butter-fat Average.	No.	Butter-fat Average.	No.	Butter-fat Average.	No.	Butter-fat Average.			
			lbs.		lbs.		lbs.		lbs.		lbs.			
Ardersier Sir Eion	Jersey			6	310.17			..		6	310 17	Pinjarra	H Skidmore	Dead
Radyr Park Sept Lad	do.	7	294.85					2	354.00	9	308.00	Harvey	L. M. Temple	5
Murray Glen Lord Avon	Friesian			9	301 33	2	261 50	5	321 20	16	302.50	Harvey	F. Byrd	Dead
Werribi David	Jersey			5	303 33			1	271 00	6	297.83	Denmark	W. Middleton	9
Summerlea Peter	A.I.S.							7	297 00	7	297.00	South Cowaramup	A. W. Dempster	Dead
Wooroloo Noble 2nd	do.			11	253.27	3	314 66	5	366.20	19	290 57	Harvey	S. Fry	Dead
Koojan Banker	Guernsey				....	3	288 00	6	290 16	9	289 44	Albany	C. J. Jarrat A. Bracknell	Dead
Walgett Ruby's Noble	Jersey			3	296 33	9	307 66	6	256.33	18	288 66	Nannup	S. C. Maidment	Dead
Colmyn Mont Rose	do.					3	239 33	5	318.20	8	288.62	North Cowaramup	G Penfold	Dead
Victoria Robin Hood	Red Poll			5	292 11			1	231 96	6	282 09	Mt. Barker	F. R. H. Pugh & Son	12
Plenarbor Master	A.I.S.			1	304.00	5	265.80			6	272.17	Pinjarra	S. Mullins	7
Brackenhurst Gibson Champagne II.	do.			10	251 50	3	268.66	14	259 50	27	257 55	Nannup	S. C. Maidment	12
Rosella Commander	Guernsey	4	257.50	6	256.50					10	256 90	Rosa Brook	T. F. Busby	6
Grassvale Designs Ruler	Jersey	9	201 15	3	268.66	1	226 50	10	305.55	23	256.45	Donnybrook	E. W. M. Trigwell	11
Melbury Chief	A.I.S.							10	247 00	10	247.00	Margaret River	J. A. Nilssen	16
Muresk Path Finder	Guernsey					1	191·00	5	255 00	6	244.33	Rosa Brook	T. F. Busby	12
Brookfields Bulwark	do.	1	165 00	4	239 00	1	278 00			6	239 16	Albany	L. Jordan	8
Denmark Rosa's Viscount	do.			1	204.00	3	250.33	14	236 14	8	236 72	Northcliffe	J. R. Daubney	12
Congelin Eminent Mariner	Jersey			1	181 50	6	244 00	3	258 00	10	236 15	Metricup	C. R. Irvine	7
Longridge Redman	A.I S.			2	229.00	6	246.33	15	277 77	23	232 69	Waroona Pinjarra	H. J. Mullins S. Mullins	Dead
San Soucci Double Success	Jersey					1	217 29	8	232.79	9	231.07	Pemberton	H. Styles	14
Eungella Golden Star Bright	do	4	232 50	2	223.00					6	229.30	Pinjarra	T. Abbott	Dead
Dunmore David	Friesian			5	240.80	8	217 87			13	226 69	Nannup	V. Scott	8
Sabina Vale Velvet Boy	Jersey					2	318 00	11	206 54	13	224 00	Nannup	A. Pollock	Dead
Rocky Glen Captain	A I S					1	174.00	5	233 60	6	223 66	Albany	F. Pease	Dead
San Soucci Prince Winston	Jersey			1	187.98	3	257 50	2	186 82	6	222 36	Pemberton	H. Styles	Dead
Muresk Jeremy	Guernsey	3	165 33	4	234.00	1	235 00	3	249 66	11	219 63	Wilga Noggerup	R. Charteris	8
Ilginup Monarch Loyalist	A.I.S	7	195.87	4	244.50	1	253 00			12	216.50	Waroona	L. Windus	8
Brookfield Bachelor	Guernsey	3	169 00	1	215 00			7	233.71	11	214 31	Margaret River	W. B. Wickham	12
Westby Grenadier	A I S.	1	210.00	2	209.00	2	215.50	5	204.20	10	207 20	Denmark	H. M. Bidwell	9
Summerlea Peer	do.			1	123 22	2	138 34	15	226.40	18	205.33	Ruabon	F. L. Torrent	Dead
Travalgan Rajah	Jersey	11	205 00					3	188.66	14	201.50	Wilga-Noggerup	Runciman & Inglis	6
Grantham Forward March	do.	1	208.00	1	206 00	2	209 50	2	187.50	6	201.33	Waroona	Bowles & Sons	7
Greenmount Silver King	do.			2	182.01	1	100 83	6	224.32	9	201.20	Donnybrook	M. A. Crute	Dead

TABLE 9—*continued.*

BULLS WITH SIX OR MORE DAUGHTERS COMPLETING LACTATION—*continued.*

Bull.	Breed.	Daughters.										Unit.	Owner.	Age o. Bull.
		2 Years Old.		3 Years Old.		4 Years Old.		Mature		Total.				
		No.	Butter-fat Average.	No.	Butter-fat Average.	No.	Butter-fat Average.	No.	Butter-fat Average.	No.	Butter-fat Average.			
			lbs.		lbs.		lbs.		lbs.		lbs.			
Denmark Damon	Guernsey					3	167.33	6	216 83	9	200 33	Northcliffe	A. V. Smith	16
San Soucci Prince Ingot	Jersey							7	191 56	7	191.56	Pemberton	A. J. Hulcup	8
Yokanup Ulerys Commodore	A.I.S.	1	175.80					5	188.12	6	186.07	Mt. Barker	C. H. Bailey	7
Colmyn Fairy Boy	Jersey			1	145.00	4	132.75	3	263.00	8	183 12	Metricup	G. M. Smith	12
Calcamine Justice	do.	6	177.07							6	177.07	Mt. Barker	A. K. Stirling	6
Gorge Rock Oxford Boy	do.	6	171.25							6	171 25	Mt. Barker	J. F. Bunker	4
Longridge Commander	do.	4	145.25	1	100.00	4	156.00	5	206.40	11	169.90	Margaret River	J. A. Nilssen	10
Mereworth Butter King	do.	7	163.28							7	163 28	Nannup	V. Scott	9
Wattle Hill Saar King	A.I.S.	10	136.30	3	204.80					13	152 11	Nannup	F. J. Oates	Dead
Summerlea Milkmaid Renown	do.					2	153.52	12	145.00	14	146 21	Nannup	Roberts Estate	9

A high producing herd in good pasture, Mt Barker.

It will be noted that of the nine leading bulls, seven are already dead and therefore their potential value has been lost. Of the 41 bulls listed, 15 are dead. This illustrates the problem with which dairy farmers generally are faced when they desire to select an animal which has been proved to be good. Under existing circumstances it appears that the finding of such an animal will be exceedingly difficult.

Data has been provided, notably by the Ayrshire Herd Society in Scotland, that the next best bull to a "proved" bull is the son of a "proved" bull, and therefore the obvious line of inquiry for a prospective buyer of a new herd sire, is to request full details of the animal offering, both in respect of the production of the material ancestry and also of the daughters and sisters of the main sires.

It can be shown that the herd sire is at least 40 times as important as any individual cow and therefore the additional time and possible expense involved in finding and buying a really good bull is justified.

Value of High Test.

The value of high butter-fat test in milk, combined with high milk yields is obvious, and emphasis has been placed on the wisdom of maintaining high quality in milk as a means of ensuring the greatest output of nutrients. This emphasis is reduced somewhat in respect to the areas producing whole milk, but even in these districts there is a weighty argument in favour of high quality

in view of the fact that surplus above whole milk requirements must be used for manufacturing purposes and that as time goes on this proportion is likely to increase.

The capacity for producing milk, and for producing milk of high butter-fat test, are characters which are inherited separately.

The farmer can improve the productive capacity of his herd by the use of bulls which are from strains, not only with records of high yields, but with which are combined the character of high test.

With a view to demonstrating the effectiveness of high test as a means of achieving a high yield, data in Table 10 was assembled from the records for the three years 1935-36, 1946-47 and 1947-48. It will be seen that the groups with the highest test have the highest average butter-fat yields; in fact there is almost a regular increase in the yields as the test rises.

TABLE 10.

AVERAGE PRODUCTION OF COWS COMPLETING LACTATION.

Grouped according to Test.

Test.	Summary of three years shown.				
	No. of Herds.	No. of Cows.	Average Milk.	Average Test.	Average Butter-fat.
			lbs.	%	lb.
3.1–3·5	5	113	4838.5	3.36	162·39
3.6–4.0	109	2076	5061.4	3.92	198.46
4.1–4.5	383	7323	4675.3	4.33	202.29
4.6–5.0	323	6086	4607.5	4.73	218.02
5.1–5.5	96	1513	4743.2	5.23	248.08
5.6 & Over	20	199	4814.0	5.71	274.42

Calf Marking and Sire Surveys.

Some disappointment can be expressed regarding the failure of many farmers having their herds tested to assist in the marking of the heifer calves. This is intended as the basis for a sire survey scheme, details of which will be announced before next season. While it is proposed that the performance of the various sires having six or more daughters under test in any year will be published as previously, detailed surveys of individual sires will be prepared on application by the members. These will be issued in three separate stages—a preliminary survey covering a number of cows with one lactation only. An intermediate survey will follow when a determined number of these cows have had a second lactation, while a final survey will be issued on the completion of a third lactation by probably a smaller number.

In view of this it is hoped that all testing members will co-operate with the recorders in ensuring that the heifer calves are marked, as this is the only means by which they may be identified later when they come into production. As the marking is recorded together with the breeding of the heifer, the sire of each marked animal coming into production will be known.

Speed of Milking.

An inquiry has been commenced into the average time taken in milking with machines and, while the data is not nearly complete, a preliminary view suggests that valuable information will be forthcoming. For example—for the period July to September the times taken by various sizes of milking machine were tabulated according to whether time taken per cow was six minutes and under, between six and ten minutes or ten minutes and over. The following table shows the results.

TABLE 11.

Size of Machine.	Speed of Milking: Minutes per Cow.			Percentage.	
	10 Minutes and over.	7–9 Minutes.	6 Minutes and under.	6 Minutes and under.	10 Minutes and over.
Units.					
6 .	3	3		6	64
5 .	8	2	1		
4 .	54	68	6	5	42
3 ..	41	233	22	7	14
2 .	41	259	101	25	10

It will be noted that of those with an average time of six-minutes-and-under, 77.6 per cent. were two-unit machines, while 94.6 per cent. were two or three-unit machines. Of those taking ten minutes-and-over, 44.2 per cent. were machines of four-units or over. Further, of the two-unit machines 25 per cent. were in the six-minutes-and-under group.

It is proposed that this inquiry will be continued as there is no doubt, from the general evidence available showing milking times from four-and-a-half to 18 minutes per cow, a large number of farmers are taking an unduly long time to milk their cows.

From modern knowledge of the physiology of milk secretion, it is obvious that considerable loss of production must be occurring. It is intended that the data be prepared in such a way that farmers may see quickly the need for speeding up the rate of milking. It is clear already from the figures, that many farmers owning large machines can milk their herds more rapidly if they put out of action one or more units. There are several herds on which

two-unit machines are used, where the total length of the milking period for the herd is less than for herds of a similar size where four and five-unit machines are in action. It appears that some of the latter have been equipped beyond the capacity of the labour available to work efficiently.

Other Investigations.

Numerous other investigations into the influence of various factors and aspects of management on production are possible and it is planned that with a change in the routine of calculating production it will be possible for the recording officers to collect data which will be of value for these purposes.

Inquiries are envisaged into the influence of mastitis, fodder conservation and other phases of management.

Leading Herds.

The performance of some of the leading herds during the past year—according to size in the categories under-20, 20-30, 31-50 and 51-and-over cows—are shown in tables 12, 13, 14 and 15.

TABLE 12.

LEADING HERDS OF LESS THAN 20 COWS.

Name of Owner.	Unit.	No. of Cows.	Breed.	Butter-fat Average. lb.
G. Barnsby	Pemberton	16	Guernsey	359.13
W. Robinson	Cowaramup, North	8	Jersey and Guernsey	340.00
K. Fimmel	Harvey	19	Jersey	333.00
J. M. Barry	Scotsdale	12	Jersey and Jersey X Guernsey	301.21
E. Oregioni	Manjimup	15	Guernsey	289.30
G. M. Cabassi	Pemberton	18	Guernsey	288.25
F. Doak	Rosa Brook	14	Mixed	281.12
B. I. Morgan	Manjimup	7	Mixed	274.80
I. S. Baldock	Bridgetown	11	Jersey	271.00
J. Cox	Pinjarra	16	Mixed	269.81
W. Gane	Rosa Brook	14	Jersey and Shorthorn	266.71
E. A. Hansen	Margaret River	18	Mixed	264.22
J. MacClaren	Forest Grove	18	Jersey	262.00
R. White	Cowaramup, North	16	Mixed	259.00
H. Hawksford	Cowaramup, North	16	Shorthorn X Jersey	258.00
R. J. Henderson	Rosa Brook	18	Jersey and Guernsey	254.16
A. Miller	Harvey	18	Shorthorn	254.00
H. S. Redman	Denmark	18	Jersey	253.50

TABLE 13.

LEADING HERDS OF 20-30 COWS.

Name of Owner.	Unit.	No. of Cows.	Breed.	Butter-fat Average. lb.
O. Foan ..	Donnybrook .	20	Jersey	379.85
G. Crooke .	Margaret River	20	Jersey	379.05
W. Middleton .	Denmark ...	21	Jersey	347.61
A. R. Testar .	Harvey ...	22	Guernsey	345.00
D. Della	Pemberton	22	Guernsey	342.64
D. G. Spark	Pinjarra	27	Jersey	333.00
L. L. Bolt .	Denmark	21	Jersey	321.30
J. A. Dowrick . .	Balingup	26	Jersey X Guernsey	320.00
M. Brennan	Balingup	26	Jersey X Guernsey	309.00
F. Campbell	Cowaramup, South	20	Jersey	304.80
K. Chapman	Wilga-Noggerup	26	Jersey and Guernsey	304.50
T. H. M. Lefroy	Cowaramup, North	23	Mixed	303.00
T. W. Jackson	Waroona	23	Mixed	300.00
A. Miller	Cowaramup, South	30	Jersey	299.93
A. Gibbs	Cowaramup, North	22	Mixed	299.45
L. J. Frost	Mt. Barker....	23	Jersey	296.67
W. Price	Donnybrook ...	26	Jersey	295.08
F. Larsen	Cowaramup, North	22	Jersey	294.00
L. M. Temple	Harvey ...	21	Friesian X Jersey...	292.00
E. Marston	Waroona	28	Guernsey X Shorthorn	288.43
C. B. Fennell	Margaret River .	24	Shorthorn	287.83
J. Stephens	Scotsdale	24	Jersey .	285.05
G. Penfold	Cowaramup, North	20	Jersey and Shorthorn	282.00
W. Donaldson	Cowaramup, North	20	Jersey .	278.00
N. L. Murdoch	Metricup . . .	25	Jersey and Jersey X Shorthorn	277.78
H. Harrison .	Rosa Brook ...	29	Guernsey	277.13
C. E. Campbell	Forest Grove	26	Jersey and Guernsey	273.00
H. Silvester	Cowaramup, South	22	Shorthorn, Guernsey and Jersey ...	272.59
N. E. Marshall	Scotsdale . .	24	Guernsey	272.43
H. S. Moyes	Bridgetown . .	28	Mixed	270.20
V. Scott	Nannup	23	Friesian . . .	269.78
R. Wright	Wilga-Noggerup	27	Mixed	269.70
D. Mett	Cowaramup, North	20	Guernsey	266.70
H. Morris . .	Cowaramup, South	21	Jersey .	266.66
J. J. Littlefair .	Pemberton	23	Mixed	264.29
R. Lang . .	Margaret River ..	29	Mixed .	261.55
E. J. Arthur .	Rosa Brook .	24	Jersey and Guernsey	261.45
C. W. Plozza	Denmark	20	Jersey and Shorthorn	260.79
W. Duggan .	Cowaramup, North	23	Mixed .	259.00
S. Shirley ...	Cowaramup, North	23	Jersey	258.45
E. F. Hick	Scotsdale .	22	Jersey .	258.24
J. H. Bessell (Jr.) ...	Rosa Brook . .	22	Shorthorn and Jersey	257.63
L. M. Wetherly ...	Ruabon . .	25	A.I.S. .	257.23
W. L. Still	Metricup	24	Mixed .	256.27
A. C. Frost	Donnybrook . .	26	Jersey	254.96
H. Stuart	Cowaramup, North	22	Jersey .	254.72
F. J. Smith	Balingup	28	Jersey	254·50
C. R. Payne	Bridgetown ...	22	Jersey	252·57
F. H. Dennis	Rosa Brook . .	27	Shorthorn	252.22
F. V. Hortin	Albany	24	Mixed . .	251.87
H. J. Clews	Cowaramup, South	27	Jersey, Guernsey and Shorthorn	251.58
McLoughlin Bros. . .	Wilga-Noggerup	22	Jersey . .	251.40
R. Charteris	Wilga-Noggerup ...	22	Guernsey	250.90
R. Benson	Donnybrook ..	30	Jersey . .	250.82
R. H. Brown	Cowaramup, South	21	Mixed	250.00

TABLE 14.

LEADING HERDS OF 31-50 COWS.

Name of Owner.	Unit.	No. of Cows.	Breed.	Butter-fat Average. lb.
M. Seia ...	Balingup	32	Jersey ...	312.00
A. B. Eckersley ...	Harvey	35	Jersey	311.00
A. W. & W. L. Langley	Cowaramup, South	48	Shorthorn . ..	300.10
V. Dezotti . .	Bridgetown .	43	Jersey .	299.00
H. H. McNeill	Waroona	43	Shorthorn	298.91
E. R. White	Harvey	47	Jersey ..	293.00
J. H. Oldfield ..	Forest Grove ...	37	Shorthorn X Guernsey	289.00
G. White .	Balingup	40	Jersey	283.00
Farr Bros. .. .	Albany . ..	34	Guernsey X Jersey	279.32
T. Maughan ..	Harvey .	45	Mixed	277.00
S. C. Maidment ...	Nannup . ..	46	Jersey and Shorthorn	272.00
P. Plozza	Nannup	35	Jersey X Shorthorn	267.00
W. H. Davis .	Pinjarra . .	43	Mixed . ..	261.37
V. Humphry ..	Pinjarra . ..	32	Shorthorn . .	260.31
G. H. Dixon . ..	Bridgetown ...	34	Jersey .	258.00
J. E. Glendon .	Ruabon .. .	44	A.I.S. . .	256.85
W. K. Barnes ...	Harvey ...	45	Shorthorn . .	254.00
A. J. S. Angel	Manjimup	36	Guernsey	252.60
R. P. Reading	Vasse-Jindong	44	Mixed	251.73
H. Skidmore ..	Pinjarra	37	Jersey .	251.46
P. J. Colum .. .	Waroona ..	32	Shorthorn X Jersey	251.44
R. A. Clarke	Brunswick .. .	41	Jersey	251.07

TABLE 15.

LEADING HERDS OF 51 COWS OR MORE.

Name of Owner.	Unit.	No. of Cows.	Breed.	Butter-fat Average. lb.
R. Beacham ...	Pinjarra . .	58	Shorthorn and Jersey	331.79
F. R. H. Pugh & Son ...	Mt. Barker	55	Mixed	280.52
S. Fry . ..	Harvey .	52	Shorthorn	277.00
E. Holthouse	Harvey . ..	51	Mixed .	273.00
Runciman & Inglis	Wilga-Noggerup ..	69	Jersey and Jersey X Shorthorn	264.40
J. Torrent	Ruabon ...	52	Jersey and A.I.S.	247.97
G. M. Dempster	Harvey	72	Shorthorn .	241.00
Radford Park .	Vasse-Jindong	67	Jersey	234.20
E. Keogh . .	Mt. Barker ..	56	Shorthorn and Jersey	231.58
R. A. & T. A. Jackson	Rosa Brook	61	Shorthorn, Jersey and Guernsey	230.93
J. Salerian ...	Waroona	63	Red Poll .	228.17
W. Bailey	Balingup	54	Jersey X Guernsey and Shorthorn	210.00
H. P. Fry	Harvey	51	Shorthorn	203.00
J. R. Daubney	Northcliffe	64	Guernsey and Shorthorn	202.00

Table 16 shows the highest producing cow in each unit.

TABLE 16.

THE HIGHEST PRODUCING COW IN EACH UNIT.

Owner.	Unit.	Cow.	Breed.	Milk. lb.	Test. %	Butter-fat. lb.
E. Holthouse...	Harvey ...	Dumpy ...	Jersey .	10,560	5.80	610.00
W. Price .	Donnybrook	Daphne	Jersey ..	8,851	6.15	544.41
F. Doak ...	Rosa Brook	Maisie 1st	Shorthorn x Jersey	12,415	4.26	529.00
G. Crooke ..	Margaret River	Betty ...	Jersey .	12,045	4.20	515.00
R. Beacham	Pinjarra .	Sylvie	Shorthorn .	11,060	4.60	510.00
G. Barnsby ..	Pemberton ..	Betty	Guernsey ...	6,960	7.28	506.76
A. W. and W. L. Langley	South Cowaramup	Ruby .	A.I.S.	11,940	4.20	504.00
J. A. Dowrick	Balingup ..	Brownie	Jersey x Ayrshire	9,210	5.20	484.00
F. Larsen	North Cowaramup	Trixie	Jersey x Shorthorn	10,140	4.57	464.00
N. L. Murdoch	Metricup .	Betty ..	Shorthorn x Jersey	8,424	5.49	463.00
R. A. Clarke	Brunswick ..	Florrie	Jersey ..	8,310	5.70	459.84
L. Winduss	Waroona .	Annabella	Shorthorn	11,085	4.10	459.00
V. Dezotti ...	Bridgetown	Betty ..	Jersey x Shorthorn	10,755	4.20	454.00
H. J. Shepherd	Mt. Barker.	Rona .	Guernsey ..	9,780	5.30	453.36
L. L. Bolt ..	Denmark .	Girlie .	Jersey	9,063	4.90	448.26
S. C. Maidment	Nannup .	Leo .	Jersey x Shorthorn	9,791	4.50	445.00
Runciman and Inglis	Wilga-Noggerup	Patsy ..	Jersey .	7,940	5.60	443.00
Farr Bros. .	Albany .	Daisy .	Guernsey ...	8,665	5.03	436.00
J. E. Glendon	Ruabon ..	Yvonne .	A.I.S. . .	10,530	4.00	430.45
Radford Park...	Vasse-Jindong	Dixie .	Jersey	7,535	5.50	429.00
A. J. S. Angel	Manjimup .	Holly .	Guernsey ..	8,973	4.70	426.00
J. H. Oldfield	Forest Grove	Wendy ...	Jersey x Guernsey	8,885	4.80	424.00
N. E. Marshall	Scotsdale	Primrose....	Guernsey	7,905	5.16	408.15
J. Adam ...	Northcliffe	Sue	Guernsey x Jersey	9,485	3.89	369.00

Co-operative Dairy Farmers Trophies.

Previously trophies were donated in the units for a variety of results. For example—the best cow, the best group of heifers, etc.

In the revised scheme only one series of trophies has been donated and these were awarded on the basis of the greatest improvement in yield over a three-year period. The trophies will be given as follows:—

First year of testing in any unit—The highest average.

Second year—The greatest improvement over two years.

In the following years—The improvement over three years.

The trophies for this purpose are donated jointly by the South-West Co-Operative Dairy Farmers Ltd., Bunbury and the Great Southern Co-Operative Butter Coy., Narrogin, and are known as the Co-Operative Dairy Farmers Trophies.

Details of the yields for 1946-47 and 1947-48 are shown in table 17.

TABLE 17.

THE CO-OPERATIVE DAIRY FARMERS TROPHY.

Owner.	Unit.	Average Butter-fat Production. lb. 1946–47.	Average Butter-fat Production. lb. 1947–48.	Points Scored.
O. Foan	Donnybrook	344	380	[illegible].20
A. R. Testar	Harvey	185	345	40.00
G. Barnsby	Pemberton	300	359	39.33
R. Beacham	Pinjarra	211	332	34.57
K. Chapman	Wilga	174	305	32.75
L. J. Frost	Mt. Barker	137	297	32.00
M. Seia	Balingup	201	312	31.71
F. Campbell	Cowaramup, South	184	305	30.25
W. Middleton	Denmark	274	348	29.60
V. J. Lowrie	Metricup	119	245	25.20
T. W. Jackson	Waroona	218	300	23.42
B. I. Morgan	Manjimup	189	275	21.50
H. S. Moyes	Bridgetown	188	270	20.50
W. G. McLaren	Albany	146	248	20.40
P. Plozza	Nannup	201	267	18.85
G. Penfold	Cowaramup, North	223	282	16.85
L. M. Wetherley	Ruabon	192	257	16.25
E. J. Arthur	Rosabrook	197	261	16.00
McSwain Bros.		174	238	16.00
W. B. Wickham	Margaret River	138	211	14.60
C. E. Campbell	Forest Grove	223	273	14.28
V. R. Sales	Brunswick	137	196	11.80
J. M. Barry	*Scotsdale	....	301	....
R. P. Reading	*Vasse-Jindong	....	252	....
J. Adam	*Northcliffe	....	249	....

* New Units 1947–48 Season.

Particulars of production of each herd under test in the various units are given hereunder.

HARVEY C.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
A. R. Testar	22	656	345
K. Fimmel	19	635	333
A. G. Eckersley	35	570	311
Herd W	47	595	293
„ F	21	555	292
„ X	52	625	277
„ D	45	611	277
„ H	51	565	273
„ Y	18	605	254
„ K	45	604	254
„ Q	24	549	249
„ M	72	558	241
„ B	48	558	237
„ O	26	418	226
„ C	38	453	206
„ Z	51	422	203
„ U	51	426	185

FOREST GROVE K.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
J. H. Oldfield	37	619	289
C. E. Campbell	26	624	273
J. McLaren	18	539	262
Herd C	19	498	237
„ AE	34	484	220
„ G	17	426	209
„ AC	33	448	202
„ B	30	418	189
„ O	39	399	180
„ AF	17	364	172
„ P	40	397	170
„ E	11	380	155
„ Z	12	317	142
„ CF	31	293	140
„ CA	13	201	132
„ CB	19	294	131
„ AB	23	262	121
„ R	19	246	108

MANJIMUP O.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
E. Oregioni ...	15	645	289
B. I. Morgan ...	7	587	275
A. J. S. Angel ...	36	559	253
Herd J ...	26	508	231
„ D ...	16	539	229
„ G ...	22	552	225
„ L ...	18	459	211
„ V ...	24	422	209
„ A* ...	29	448	207
„ E* ...	12	378	205
„ N ...	19	514	202
„ U ...	50	464	196
„ S ...	41	420	192
„ T ...	22	396	192
„ K ...	51	416	186
„ C ...	30	436	180
„ E ...	19	382	178
„ B ...	30	434	169
„ P ...	25	463	167
„ M ...	31	379	158
„ X ...	32	377	140
„ R ...	16	293	129
„ D* ...	22	247	123

* Inverted.

MARGARET RIVER I.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
G. Crooke	20	764	379
C. B. Fennell	24	691	288
E. A. Hansen	18	597	264
Herd Y	29	623	262
„ N	11	528	247
„ X	29	520	241
„ E	23	538	229
„ XV	27	594	217
„ S	20	560	215
„ D	37	497	211
„ O	20	436	211
„ XY	19	492	210
„ G ..	17	448	205
„ XS	31	444	204
„ XT	22	475	192
„ A ..	49	509	189
„ P	48	456	184
„ B	22	391	177
„ XU	28	339	134
„ XR	53	281	124
„ XW	15	213	102
„ A*	4	178	95

* Inverted.

DONNYBROOK L.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
O. Foan	20	752	380
W. Price ...	26	541	295
A. C. Frost ...	26	467	255
Herd D ...	30	487	251
„ N ...	6	488	249
„ AD ...	25	476	241
„ Y ...	37	481	239
„ Q ...	22	421	228
„ B ...	43	439	206
„ J ...	29	391	206
„ W ...	29	382	200
„ U ...	8	445	195
„ X ...	32	388	191
„ AB ...	30	415	191
„ V ...	32	450	187
„ S ...	19	393	180
„ Z ...	24	401	178
„ F ...	20	342	161
„ AC ...	18	308	141

DENMARK W

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
W. Middleton ...	21	675	348
L. L. Bolt ...	21	710	321
C. W. Plozza ...	20	575	261
Herd A ...	18	492	254
„ J ...	20	568	241
„ E ...	30	563	230
„ C ...	12	497	225
„ I ...	15	486	214
„ T ...	6	473	201
„ O ...	40	511	200
„ U ...	17	437	196
„ V* ...	15	449	196
„ Y ...	19	418	191
„ V ...	29	416	182
„ R ...	18	390	178
„ F* ...	17	395	172
„ B ...	7	354	172
„ J* ...	26	341	158
„ K ...	14	276	119

* Inverted.

NORTHCLIFFE X.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
J. Adam ...	25	583	249
L. C. and A. W. Lewis	28	496	226
K. Rising ...	23	542	223
Herd K ...	22	518	216
" L ...	12	431	214
" D ...	64	483	202
" A ...	24	444	198
" V ...	34	449	192
" Z ...	30	434	181
" H ...	31	464	180
" O ...	24	399	176
" S ...	28	381	173
" B ...	39	393	162
" P ...	41	349	152
" G ...	16	365	138
" E ...	25	323	137
" Y ...	22	309	130
" F ...	39	306	125
" M ...	26	251	109

NANNUP U.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
S. C. Maidment ...	46	648	272
V. Scott ...	23	771	270
P. Plozza ...	35	605	267
Herd U ...	42	569	240
" D ...	36	513	205
" L ...	28	384	203
" X ...	48	474	197
" AD ...	24	423	194
" AB ...	18	341	183
" F ...	45	451	181
" T ...	29	347	177
" AE ...	29	400	162
" H ...	31	372	158
" V ...	19	285	157
" R ...	23	398	153
" A ...	22	320	143
" AC ...	17	336	130
" S ...	21	348	126

COWARAMUP, NORTH, G.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
W. Robinson ...	8	652	340
T. H. Lefroy ...	23	686	303
A. Gibbs ...	22	659	299
Herd F ...	21	650	294
" P ...	20	578	282
" DD ...	20	562	278
" O ...	20	509	266
" G ...	23	580	259
" I ...	16	602	259
" CC ...	23	510	258
" Z ...	16	547	258
" N ...	22	491	254
" EE ...	26	548	248
" A ...	29	507	246
" Q ...	12	528	245
" S ...	17	482	241
" J ...	25	510	239
" E ...	28	483	231
" AA ...	10	416	213
" M ...	28	454	208
" BB ...	15	417	205
" U ...	41	423	203
" X ...	38	453	202
" C ...	32	373	176

MOUNT BARKER S.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
L. J. Frost ...	23	611	297
F. R. H. Pugh & Son	55	638	281
Cluett & Sons ...	32	544	245
Herd M ...	36	518	235
" W ...	21	429	233
" B ...	33	493	233
" K ...	56	557	232
" F ...	18	528	231
" Q ...	24	525	228
" Z ...	31	468	225
" U ...	27	565	223
" E ...	32	532	223
" A ...	24	437	210
" X ...	11	445	207
" A* ...	24	517	207
" Y ...	26	428	206
" T ...	35	484	200
" P ...	24	456	198
" G ...	28	420	162
" I ...	21	304	141
" V* ...	8	361	133

* Inverted.

ROSA BROOK J.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
F. Doak ...	14	581	281
H. Harrison ...	29	613	277
W. Gane... ...	14	522	267
Herd X ...	24	569	261
„ E ...	22	554	258
„ N ...	18	530	254
„ L ...	27	586	252
„ K ...	33	541	245
„ F ...	27	584	238
„ T* ...	16	496	234
„ O ...	12	459	233
„ Y ...	30	449	232
„ U ...	61	516	231
„ F* ...	17	441	230
„ A ...	28	539	228
„ P* ...	16	485	220
„ C* ...	42	426	214
„ D* ...	31	464	209
„ M ...	14	452	207
„ B* ...	14	430	207
„ Z ...	29	431	191
„ U* ...	13	459	179
„ G ...	24	364	171
„ A* ...	15	325	157

* Inverted.

WILGA-NOGGERUP R.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
K. Chapman ...	26	582	305
R. Wright .	27	642	270
Runciman and Inglis . .	69	525	264
Herd D .	22	474	251
„ A .	22	527	251
„ E	6	463	231
„ F . .	26	435	228
„ B	24	470	213
„ N .	7	452	210
„ L	18	478	199
„ P	19	434	199
„ U .	15	414	196
„ C* .	22	485	183
„ M .	23	461	191
„ H	15	376	187
„ Y	24	404	152
„ Q .	48	339	150
„ Z .	17	410	149
„ J* .	41	368	137
„ V	10	334	135
„ S ..	18	242	123

*Inverted.

PEMBERTON P.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
G. Barnsby .	16	558	359
D. Della	22	780	343
G. M. Cabassi	18	672	288
Herd A	23	575	264
„ M	21	569	247
„ K .	10	560	240
„ Y .	33	481	228
„ P .	18	479	227
„ W	19	563	226
„ G .	15	498	222
„ O . .	18	491	221
„ D ..	23	481	201
„ Q .	16	440	200
„ T .	35	404	180
„ C ..	23	386	179
„ R	12	376	170
„ S ...	31	402	166
„ Z . .	7	374	165
„ X .	23	359	164
„ L . .	15	376	163
„ U	21	356	155
„ J . ..	8	293	134
„ V	32	299	132

BALINGUP M.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
J. A. Dowerick ...	26	680	320
M. Seia	32	664	312
M. Brennan ...	26	674	309
Herd N ...	40	546	283
„ A ...	28	535	254
„ BE ...	27	540	247
„ BF ...	11	546	245
„ BC ...	11	582	234
„ BN ...	15	488	231
„ R ...	40	449	228
„ BA ...	48	551	222
„ BH ...	54	487	210
„ D ...	30	421	206
„ BJ ...	24	433	199
„ V ...	70	491	192
„ C ...	29	411	185
„ BK ...	21	352	166
„ BG ...	29	347	158
„ F ...	21	345	154
„ BM ...	13	281	115
„ P ...	22	297	109
„ BL ...	44	262	108
„ BD ...	4	225	98

METRICUP F.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
N. L. Murdoch ...	25	588	278
W. L. Still ...	24	626	256
E. Smith	12	513	247
Herd F ...	15	618	245
" D* ...	20	572	239
" E* ...	12	558	238
" A ...	32	568	232
" G* ...	29	552	218
" L ...	14	551	203
" Y ...	31	427	198
" T ...	46	465	188
" Z ...	19	456	181
" O ...	23	471	174
" K* ...	58	417	169
" J* ...	28	358	149
" Q ...	18	327	136
" A* ...	29	336	135
" X ...	58	325	129

* Inverted.

BRUNSWICK D.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
R. A. Clarke ...	41	465	251
J. Gilmour (Jun.)	35	506	236
V. Robinson ...	31	475	222
Herd T ...	33	438	221
" F ...	29	497	220
" W ...	42	516	219
" J ...	47	429	218
" U ...	53	497	208
" S ...	43	459	205
" O ...	24	477	196
" N ...	27	434	192
" X ...	24	425	179
" R ...	37	352	150

RUABON E.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
L. M. Wetherly	25	618	257
J. E. Glendon ...	44	632	257
J. Torrent ...	52	602	248
Herd Z ...	43	520	220
" T ...	27	504	218
" Q ...	28	525	215
" H ...	38	494	211
" A ...	39	460	207
" U ...	29	456	200
" B ...	57	496	198
" G ...	42	434	192
" W ...	33	446	188
" X ...	24	422	185
" J ...	25	447	180
" Y ...	41	379	150
" S ...	20	384	146

BRIDGETOWN N.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
V. Dezotti ...	43	610	299
I. S. Baldock ...	11	612	271
H. S. Moyes ...	28	706	270
Herd Z ...	34	497	258
" P* ...	22	520	252
" W ...	39	478	249
" S ...	39	507	222
" IX ...	19	489	219
" R* ...	20	443	217
" L ...	30	466	215
" T ...	26	438	196
" L* ...	19	415	190
" V ...	41	398	189
" A* ...	12	439	189
" B ...	25	437	183
" Q ...	56	443	174
" T* ...	40	366	170
" Y ...	21	396	170
" K* ...	14	383	160
" X ...	21	386	156
" Y* ...	10	325	152

* Inverted.

ALBANY T.

	No. of Cows.	Milk Average.	Butter-fat Average.
		gals.	lbs.
Farr Bros. ...	45	564	279
F. V. Hortin ...	24	580	252
W. G. McLaren ...	18	526	248
Herd W ...	29	591	246
" A ...	29	484	239
" K ...	20	491	237
" M ...	21	462	224
" Z ...	18	505	222
" U ...	15	513	219
" N ...	27	510	217
" B ...	12	458	217
" C ...	24	545	212
" X ...	13	496	212
" H ...	37	434	208
" A* ...	19	459	207
" O ...	24	451	206
" P ...	25	431	199
" V ...	15	449	197
" R ...	31	359	146

* Inverted.

PINJARRA A.

	No. of Cows.	Milk Average. gals.	Butter-fat Average. lbs.
D. G. Spark ..	27	672	333
R. Beacham ..	58	744	332
J. Cox ..	16	611	270
Herd X .	43	569	261
„ F	32	661	260
„ R ..	37	509	251
„ P	25	610	241
„ Y	18	418	215
„ K	32	429	204
„ S	31	481	200
„ Z	67	501	197
„ J	25	439	196
„ U	54	452	192
„ O	38	404	183
„ G .	18	381	169
„ W	34	378	152
„ V	14	214	116

WAROONA B.

	No. of Cows.	Milk Average. gals.	Butter-fat Average. lbs.
T. W. Jackson	23	641	300
H. H. McNeill	43	655	299
E. Marston .	28	639	288
Herd K	32	646	251
„ E	11	504	248
„ V	50	637	246
„ J	34	536	245
„ I	24	505	238
„ R	31	539	238
„ H .	27	502	229
„ M	63	488	228
„ S .	16	515	226
„ U ..	20	504	223
„ B .	24	473	220
„ T ..	30	458	220
„ Q .	20	438	188
„ P .	35	420	178
„ O ..	9	321	148

COWARAMUP, SOUTH, H.

	No. of Cows.	Milk Average. gals.	Butter-fat Average. lbs.
F. Campbell ...	20	590	305
A. W. and W. L. Langley ...	48	765	300
A. Miller ...	30	589	300
Herd Q ...	22	619	273
„ MO ...	21	562	267
„ J ...	27	552	252
„ R ...	21	623	250
„ W ...	20	583	250
„ AA ...	11	500	243
„ DD ...	35	604	233
„ HH ...	15	556	228
„ O ...	21	515	214
„ KK ...	11	482	202
„ EE ...	17	443	190
„ GG ...	15	446	188
„ U ...	7	361	146

SCOTSDALE Y.

	No. of Cows.	Milk Average. gals.	Butter fat Average. lbs.
J. M. Barry	12	628	301
J. Stephens ..	24	565	285
N. E. Marshall	24	572	272
Herd C	22	522	258
„ Z .	19	495	245
„ M ..	28	532	230
„ D	18	467	226
„ N ...	41	472	222
„ B ...	16	460	216
„ S ...	15	407	211
„ A .	12	486	211
„ F	24	372	172
„ I	20	357	155
„ L ...	15	311	142
„ H ...	20	340	136
„ J	43	270	119
„ K	24	245	109

VASSE-JINDONG V.

	No. of Cows.	Milk Average. gals.	Butter-fat Average. lbs.
R. P. Reading	44	601	252
Radford Park	67	477	234
S. A. Grey	14	455	224
Herd G	36	484	218
„ A	33	475	208
„ L ..	20	506	208
„ P ..	51	474	195
„ T	34	419	193
„ I	21	471	192
„ J	24	456	181
„ H ..	22	414	179
„ R ...	20	425	174
„ O ...	24	421	173
„ N	29	360	147
„ E .	33	336	140
„ F	19	361	139
„ D ..	[illegible]	325	138
„ C	27	271	117
„ S ..	9	197	85

SOIL CONSERVATION.

Methods for the Control of Water Erosion.

By L. C. LIGHTFOOT—Senior Soil Conservation Officer.

SUMMARY.

Water Erosion is Taking Toll of the State's Soils.

Soil erosion by water action is common in our agricultural areas, but rarely severe. The region receiving 13 to 25 inches of rain a year is most affected.

How Does Water Erosion Take Place?

Raindrops batter bare soil which is thrown up in the splash and falls mostly downhill on sloping land. The battered soil usually absorbs less water. So run-off starts earlier and is greater. Moving films of water cause **sheet erosion** *and tend to concentrate and cut causing* **gully erosion**. *Exhausted soils erode more easily.*

How to Control Water Erosion?

Cover on the surface protects the soil by absorbing the energy of pounding raindrops and by checking water movement. Dense pasture gives the best surface cover. Fertile soils resist erosion better. Improved pasture in crop rotations is the best way of making soils more fertile. Subterranean clover is the best plant for improving pasture and is already causing an agricultural revolution in many districts by making exhausted soils fertile. These principles and their application are discussed, and the additional use of mechanical methods where needed.

Western Australia has the opportunity to save and improve the soil before irreparable damage is done. Exhausted soils can usually be improved. But when the topsoil itself is carried away by erosion, the problem of making sub-soil farming pay is frequently insoluble.

SOIL EROSION CAUSED BY WATER ACTION IS COMMON IN WESTERN AUSTRALIA.

In Western Australia, the most urgent need for making soil conservation methods the basis of farming practice, is on sloping land in the fifteen to twenty-five inch rainfall areas of the South-West Land Division. Evidence of soil erosion is already widespread from Northampton to Gnowangerup, but damage as yet, is rarely severe. This erosion has been caused mainly by the uncontrolled run-off of rainwater not absorbed by the soil. Hence this article is written principally with the needs of this part of the cereal and sheep areas in view.

HOW DOES WATER EROSION TAKE PLACE?

Raindrop Pounding.—If rain is watched, it will be seen that each drop hits the soil surface and throws up a splash like a small bomb exploding. (See Fig. 1.) Recent investigations have shown that rain falling on bare soil does two things:—

1. Causes soil movement by raindrop splash.
2. Slows up water absorption by the soil, either by the formation of a dense surface skin or of a pasty mass of soil and water.

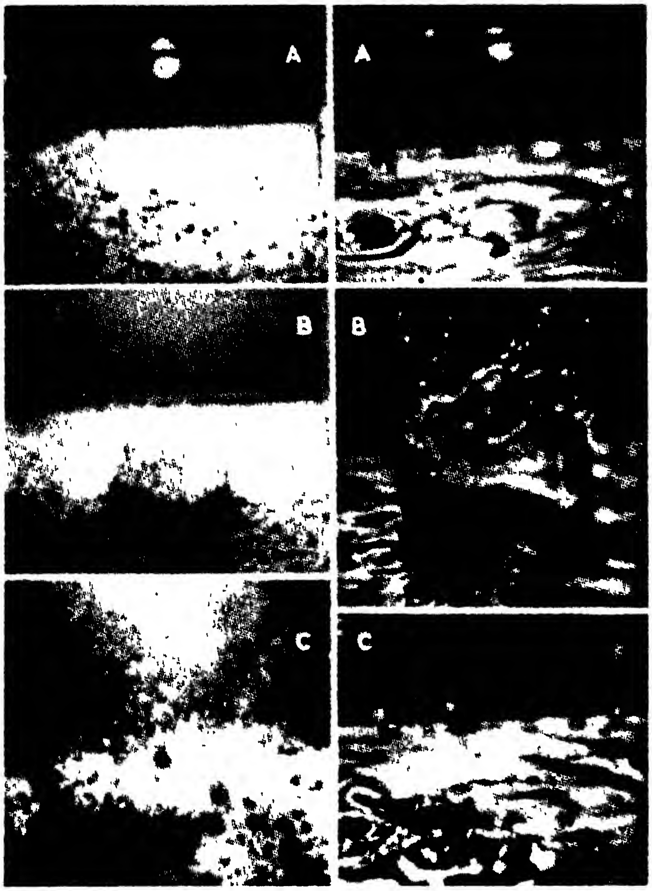


Fig 1

Y Z.

Fig 1Y: A large drop striking loose, powdery soil resembles, in slow motion, the blast of an air bomb. A: Just before striking. Notice the absence of any tail on the drop. B. Just after striking. C. Four-hundredths of a second later, the air is filled with flying soil particles.

Fig. 1Z: When the soil is covered with a film of water, the principal effect of drop impact is to create turbulence. A: Just before striking. Notice the absence of any tail on the drop. B. Just after striking, the soil surface is discernible through the transparent walls of the liquid cylinder. C: turbulent wake left by the collapse of the walls of the cylinder.

(Photography by Edgerton, Germeshausen and Grier) from Agricultural Engineering, Vol. 21, No. 11, November, 1940.

On flat lands, these effects do not result in water erosion, but on sloping lands, splash falls mostly downhill. It has been shown that up to 75 per cent. of the splash falls downhill on a 10 per cent. slope. As the splash contains up to 40 per cent. of soil, raindrop pounding alone without running water, can cause soil erosion on slopes. (See Fig. 2.)

Fig. 2.

Vertical marks indicate paths of falling raindrops, parabolic curves indicate trajectories of soil and water particles which splash from the soil surface as part of the reaction to the impact

(From Agricultural Engineering, Vol 25, April 1944.)

Sloping Soil and Running Water.—The surface sealing effect of raindrop battering causes much more run-off. Water running off sloping land carries soil particles thrown up by raindrop splash, and moves in a shallow sheet carrying a thin layer of soil. This effect is known as *sheet erosion,* and is very hard to detect. It is frequently the most serious form of erosion and may go on until most of the top soil is carried away, before becoming obvious.

Running Water Tends to Concentrate and Cut.—As water moves downhill it tends to concentrate in hollows and cut small grooves known as *rills,* or deep trenches known as *gullies.* Trenches about 18 inches wide and 10 to 12 inches deep or bigger, are normally called gullies.

Rill erosion is easier to detect than sheet erosion, but is easily worked over with cultivating implements and forgotten. It is therefore, usually as neglected as sheet erosion. Continued washing in the same rills, enlarges them into gullies. Uncontrolled gully erosion has ruined parts of some paddocks in Western Australia for cultivation, and has caused the abandonment of whole regions in the United States of America. (See Fig. 3.)

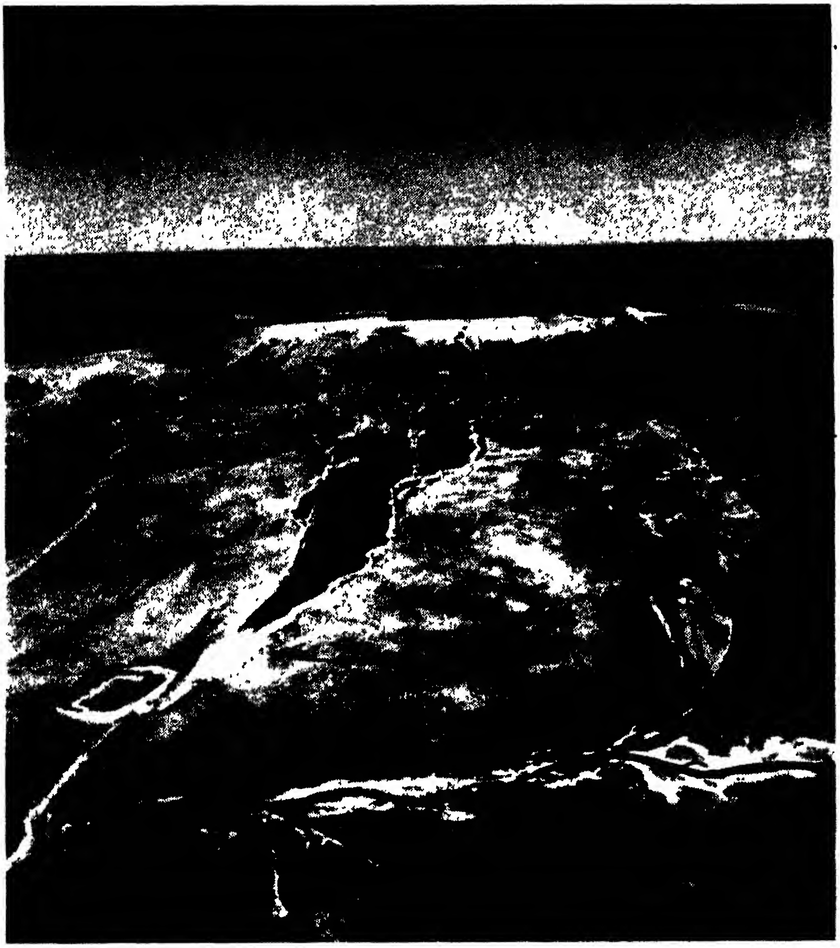


Fig. 3: Gully erosion has already made part of this wheatbelt paddock unfit for cultivation. Some of the gullies obviously follow old cultivation lines straight downhill. The gully on the right is extending uphill and unless adequate control measures are taken the whole paddock will become uncultivable. Improved pasture would probably arrest further erosion until parts of the paddock could perhaps be protected for safe cultivation by contour banks.

—Airphoto. Kingsley Watson.

Deposits of Erosion Debris.—Frequently, transported soil and sub-soil are deposited by running water on fertile land in the valleys where slopes are more gentle. This sediment is often infertile and damages good land. (See Fig. 4.)

HOW TO CONTROL WATER EROSION?

Main Needs are Surface Cover and Soil Fertility.—Investigation has shown that cover above the surface protects the soil against the poundings of raindrops. A sufficiently dense cover prevents the raindrops from throwing up soil in the splash as the force of the drops is absorbed by the cover, not by the protected soil underneath. The soil is also protected against the formation of a surface sealing skin and thus the rate of water absorption can continue undiminished. In addition to absorbing water more quickly while rain is falling, the soil is also

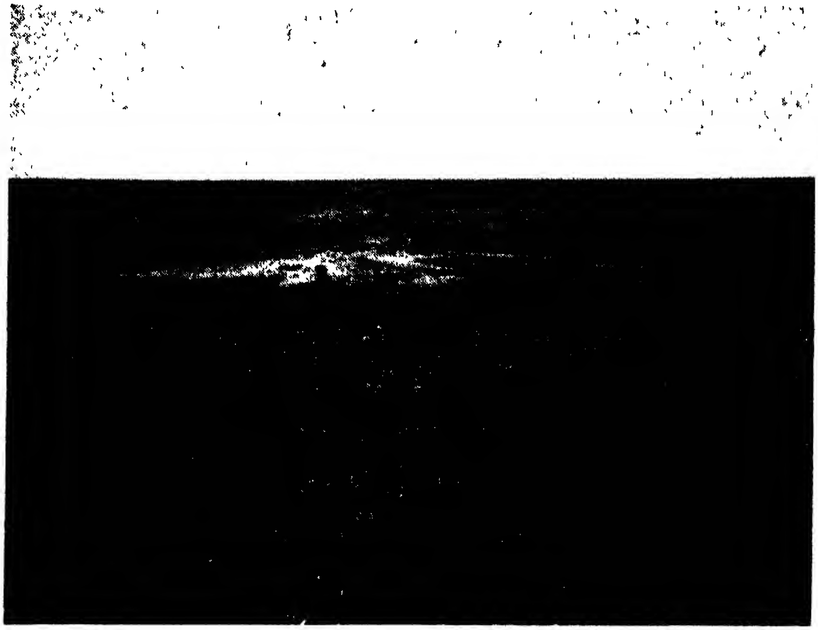


Fig. 4.—Erosion deposits in the Northam district. The lighter area above the fence posts is a deposit of soil and subsoil from the small gully above it. This gully is hardly bigger than a large rill.

Photo—Govt. Printer.

able to absorb much more water up to the limit of its capacity to hold it. In contrast when the sealing effect is present to a very high degree, dry soil has been found two inches below the surface after heavy rains. In addition, the presence of cover on the soil surface greatly slows up the rate of moving water when run-off does occur during periods of intense rainfall.

On farm lands, surface cover is most economically provided by crops or pastures. The efficiency of plant cover in giving soil protection, depends on the density of the stand and the amount of soil left uncovered. Living plants use great quantities of water during growth, mostly between 300 and 1000 times the weight of the dry matter formed in the plant. If there is any tendency to excess water in the soil, living plants are desirable. But obviously, cover is effective whether the plants are alive or dead, *as its principal functions are to absorb the force of the falling raindrops before they hit the soil surface, and to slow up the rate of moving water when run-off occurs.* The most efficient plant cover is provided by plants which grow densely, near the soil surface. Improved pastures do this job best.

These findings are of the greatest importance, and emphasize the need for plant cover on the soil surface during the longest possible part of the rotation. Further, the need for a different outlook when gauging carrying capacity is

Fig 5A.

A.—Light land at Wongan Hills sown to clover 1941, except the light coloured strip. The clover was ploughed and seeded to wheat in autumn 1947, and yielded better than 30 bushels an acre. In 1948 wheat was again seeded. Note better crop and darker soil where five years of clover pasture has added organic matter to the soil. Photo taken on 23rd June, 1948 —Photo G. H. Burvill

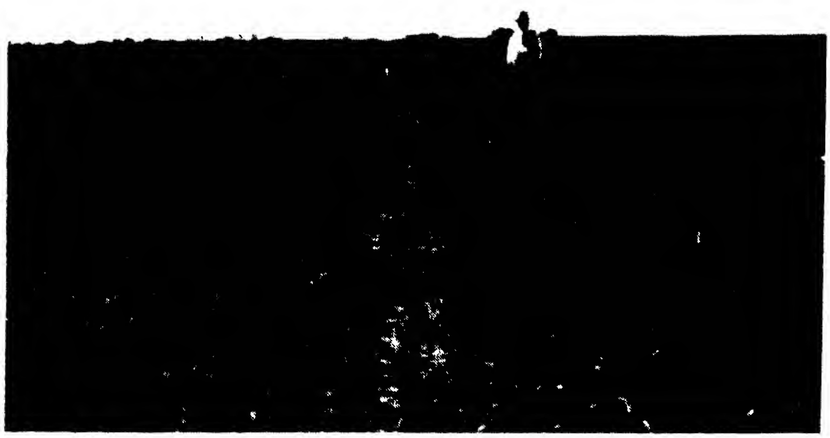


Fig. 5B.

Photo taken October, 1948, on same strip as in A, but on the other side. Estimated wheat crop on old clover land at right, 21 bushels, and where clover not seeded, 7 bushels an acre. This land was also under wheat in 1947.

—Photo G. H. Burvill

emphasized. Some of the most serious water erosion has occurred on pasture lands grazed bare. In the long-run, it is likely to be more profitable to leave some pasture to protect the soil, because when topsoil is lost, production and income decline, and when much topsoil is lost, productive capacity is usually impaired for a long time.

Soil Fertility.—Investigations have shown that fertile soils resist erosion best. The need to maintain and improve fertility then, is important to protect the soil from erosion, and to protect farm income.

Improved Pastures Best Meet Needs for Soil Cover and More Fertility.—Clearly, improved pastures green or dry, best meet the need for dense cover close to the ground providing they are not overgrazed. Legumes such as clover and trefoils are especially valuable for grazing on account of their high protein content, and for soil improvement because the bacteria in their root nodules are able to fix nitrogen from the air, and this eventually enriches the soil when the plant is grazed or dies.

Subterranean Clover Improves Pastures.—Subterranean clover is by far the most valuable legume for improving pastures in south-western Australia. It grows well on practically all soils where there is enough rain, and on most soils of medium and light texture in the 15-25 inch rainfall zone. In the northern agricultural areas, it needs rather more rain than for similar soils in the central and southern parts.

The establishment of good stands of clover needs longer pasture periods than has been the rule in wheat belt rotations, unless initial seeding rates are very heavy, and its introduction frequently means adjusting the farm rotation.

Crop Rotations.—The practice of crop rotation developed from the need to maintain and improve soil fertility and production, and the suitability of any rotation to a particular area will be measured by the success of the rotation in fulfilling these needs. Periods of pasture are desirable on all soils and in all types of mixed farming. ***Numerous experiments and the experience of farmers generally, in Australia and overseas, have shown that the most effective and economical method of improving soil fertility is by the inclusion of a pasture period in the rotation.*** (See Fig. 5.)

Clover often takes from three to five years for good establishment and gives good results for up to six or seven years. The adoption of much heavier rates of seeding, up to 10 to 15 lb. per acre by farmers who are gathering their own seed, has given good stands in one year.

Clover Disease.—There are the difficulties associated with the breeding of sheep grazed on pastures dominated by the Dwalganup strain of subterranean clover used in the wheat belt. But the Department of Agriculture continues to advise farmers to extend their areas of improved pastures by planting more Dwalganup subterranean clover because of its outstanding value in crop rotations. (See Figs. 5A and 5B.)

Other Legumes Needed.—Clover does not meet all needs for increased carrying capacity and soil protection and improvement in these areas. The Western Australian Blue Lupin is also a valuable legume for these purposes.

Barrel clover and burr trefoil are useful where they do well, mostly on soils of medium and heavy texture. Peas are grown to a minor extent. The search for other legumes is proceeding actively and a vetch (*Vicia eurillia*) has given promising results on the Departmental Research Stations.

Subterranean Clover Pre-eminent for Soil Conservation.—But subterranean clover is more adaptable to most situations than these other legumes, and thus remains pre-eminent for soil conservation purposes in south-western Australia.

Perhaps the most important immediate aim of the Soil Conservation Service of Western Australia is to encourage the establishment of clover wherever soil and climate permit.

Surface Cover on Very Poor Soils.—Cereal rye is very useful for establishing cover on areas where other crops and pastures have failed as it will make moderate growth on exhausted, deficient and eroded soils. It has made good cover on steep eroded slopes and is likely to assist establishment of subterranean clover or lupins in such cases. Seeding at 30 to 50 lb. with superphosphate at 80 to 100 lb. an acre is recommended for cereal rye. (See Fig. 6)

Fig. 6.—Cereal rye has made good cover on this poor, deficient soil, which had been as bare as the unseeded foreground. This cover will assist contour working and contour banks to control water erosion on lower sloping land. —Photo. Govt. Printer

*Working the Land**—Fallowing as practised in Western Australia leaves the soil bare for many months and greatly increases the erosion hazard on sloping lands. A rough cloddy surface absorbs water better and resists erosion better than a fine mulch. Soils on which good subterranean clover pastures grow,

* See G. H. Burvill "Changing Ideas in Soil Conservation," Journal of Department of Agriculture, W.A., Vol. 22, March, 1945, pp. 3-10, reprinted as Leaflet 809.

will in most cases produce cereal crops without a period of bare fallow. Many sloping lands will need contour working or contour banks if they are to be fallowed safely.

MECHANICAL METHODS FOR CONTROL OF WATER EROSION.

Unfortunately, there are some lands which by reason of soil type and slope, cannot safely remain in cultivation without more protection than the measures already suggested. In such cases, resort must be made to what are known as mechanical methods of erosion control.

Contouring.—Contouring refers to any cultivation practice or mechanical treatment of land applied across the slope on the level, that is on the contour. (See Fig. 7.) It has been customary to work round and round paddocks regardless of slope, but on lands vulnerable to water erosion, this practice must be modified and contour working adopted.

Contour working means that all field operations are done around the hillside, on the level across the slope. The machines of course, are tilted by the slope of the ground, but they work along lines joining points of equal level.

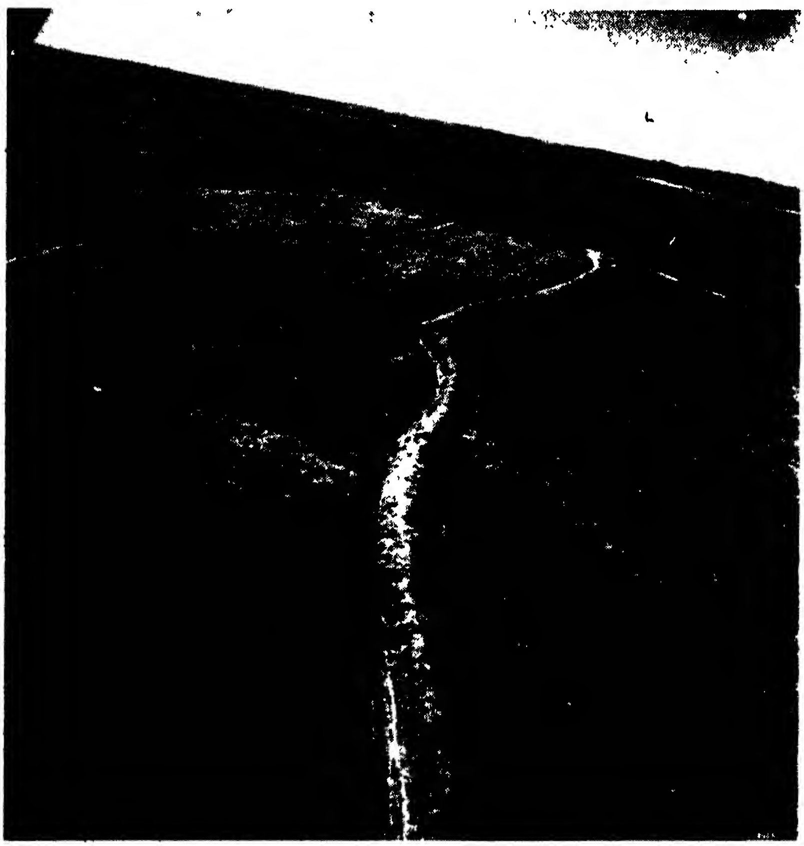


Fig. 7.—Contour working between contour banks in the Northam district. Note contour seeding (lower centre) and reclaimed gully (centre) where bank curves uphill. This gully was ploughed in and reclaimed after higher banks were built to divert possible run off from the upper slopes. Other old gullies are also visible. Contour working between these banks was not as inconvenient as expected, and less power was required. Airphoto—Kinglsley Watson.

Extent of Need for Contouring.—Contour working is likely to be needed on all land suitable and used for cultivated crops in the 15-25 inch rainfall zone, having slopes between three per cent. and 10 to 12 per cent. Land slopes of one-and-a-half to three per cent. may require contour working in special cases.

For practical purposes, contour lines may be pegged out from three to five chains apart, and the area between each pair of lines worked round and round as a land. This will keep most of the working, except at the ends, nearly on the contour. Every plough furrow and combine ridge will help to hold rain on the soil where it falls, till absorbed. The disadvantages of contour working are the extra turning required, especially as one contour line is rarely parallel to the next, and the extra time taken to cover the ground. In Western Australia these have been less than anticipated, and are outweighed by the conservation of both soil and water. When ploughs are being used on the contour, much turning may be saved by finishing the odd shaped pieces in the middle of lands with the scarifier. The corners should not be cultivated or drilled unless this is done before working round and round. Fuel consumption is lower by about eight to ten per cent. as less power is needed to work on the contour.

Contour Pasture Furrows.—Land steeper than 10 to 12 per cent. in slope, that is with 10 to 12 feet fall in 100 feet along the ground, should not be used for arable farming except in special circumstances. Such land is better used for pasture. In many cases, contour pasture furrows will be needed to help protect the soil against water erosion. These are furrows ploughed around hillsides joining points of equal level, that is on the contour, and may be made with a plough or a suitable grader. (See Fig. 8.) The grader-ditcher is suitable

Fig. 8.—Contour furrows at Camden, New South Wales, ploughed in 1943 on bare hillside. This photo taken August, 1946, shows grass cover established since contour furrowing. When sloping land becomes bare big rains sometimes wash all seeds from the surface. Contour furrows help to hold seeds as well as water on sloping lands.

Photo—L. J. H. Teakle.

for this work on slopes up to 15 per cent. Spacing is varied according to circumstances and is commonly eight to 30 feet. Contour pasture furrows hold run-off water for absorption by the soil, serve as convenient markers for top-dressing, and necessitate contour working for pasture renovating. A disadvantage is that sheep sometimes get down in them and need help to get up.

The limited experience of contour pasture furrows so far available in Western Australia has shown good results in helping pastures on steep land to control loss of top soil. In some cases, pasture furrows have effectively stopped gully erosion and allowed effective reclamation. The furrows should be blocked near rills and gullies to make sure they do not serve to bring water into them. New furrows should be watched during the first heavy rain and blocked where needed as most furrows are off the true contour in places.

Contour Banks.—There are many areas where contour working and sound rotations of crops and pasture will together be inadequate to control erosion if cropping is continued. These will comprise sloping lands already suffering from gully and sheet erosion; probably most of the steeper slopes of between five per cent. and 10 to 12 per cent., and the more readily erodible soils steeper than two to three per cent. in slope. In such cases, contour banks will be needed in addition to other methods previously mentioned, which are suitable for application in the particular paddock.

Contour banks are ridges or banks of soil built at intervals across the slope. (See Figs. 7 and 9) Commonly, they are given a small variable grade of from one or two inches per 100 feet at the beginning, to four inches per 100 feet at the outlet end. In some circumstances, this fall is increased to six inches per 100 feet. Such contour banks are known as the drainage type and provide a wide shallow water channel above each bank, which during heavy rains intercepts run-off water flowing downhill. These take the run-off slowly across the slope, and must discharge into a waterway that will dispose of excess water safely. By this method water is not allowed to run far enough downhill to cause gully formation, and sheet erosion is reduced to a minimum. More detailed specifications of contour banks recommended for Western Australia are given in a later section. (See Fig. 9.)

Contour banking is the most costly method of controlling soil erosion and for success must be supported by such other methods as are suitable to the needs of each piece of land. It is a modification of hillside terracing, a soil conservation method used by man for many centuries. Contour banks like contour lines, must be set out with an accurate levelling device, and the water channels tested again after the banks have been built with plough or grader. In Western Australia, contour banks set out by eye have failed, but those set out with a level, and given some attention for maintenance, have been successful Gully reclamation increases costs, and where contour banks are required, they should be built before soil erosion occurs.

Our agricultural areas receiving less than 15 inches of rainfall a year, do not show the same evidences of water erosion, but will need some of these methods in some places. Areas receiving more than 25 inches a year, are generally protected by pasture and have suffered comparatively little soil erosion. But where frequent cultivation is practised, particularly in orchards, much top soil has been lost. Many orchards require some contour drains to help prevent water erosion.

Scale of this photo: 1 inch = 8 chains approximately.

Fig 9 Aerial photographic plan of portion of an area in the Northam district protected against soil erosion by a system of contour banks. The hill top is at the top of the photo and the land slopes generally towards the bottom of the picture. A ridge runs from top to bottom of the photo. to the left of the centre fence and is indicated by the contour banks curving towards the bottom and back again Banks on the right of the ridge are graded to discharge into the waterway shown at the top right and those on the left to run the other way to the fence at the left. This runs down a valley generally well grassed. The double lines to the left of the left of the ridge from top to centre define a low rocky ridge. Banks discharge into this on the right and start again on the left still running to the left fence At the bottom left three gullies join, the middle one is nearly one chain wide at the top and six to eight feet deep. A number of reclaimed gullies cross the contour banks roughly at right angles and some of these are clearly shown in the photo. The paddock at bottom right has been contour banked since the photo. was taken.

—Airphoto: Kingsley Watson.

Gullies.—Many farmers do not become aware that soil erosion is robbing them of the precious top soil until gullies appear, and make their paddocks awkward to work. (See Fig. 3.) They are then anxious to treat them and reclaim the gullies. *The important thing is first to deal with the conditions which caused the appearance of those gullies.*

Until this is adequately done, attempts at gully reclamation mostly serve to accelerate the gullying process. The need to prevent gullies or to treat them in the earliest stages after first dealing with the causes, is well put by H. H. Bennett, Chief of the United States Soil Conservation Service, in his book "Elements of Soil Conservation." Bennett says (pp. 246-247) :—

"It is easier to prevent the development of gullies than to control them after they have formed. Gullying usually is preceded by sheet washing and therefore may be prevented to a large extent by taking the steps necessary to check such surface washing. However, constant precaution is necessary on sloping land to prevent the formation of gullies through the enlargement of minor channels formed by farm roads, wheeled machinery, livestock trails, temporary drainage ditches, and the excavations of rodents. (See Fig. 10.) Usually, rather simple measures such as the relocation of roadways as nearly as possible on the contour, development of minor ridged checks across roads, filling of ruts and rodent tunnels with straw or rock, and the relocation of fences in order to shift stock trails, are sufficient to check many incipient gullies, if used in time.

Fig. 10.—This gully in the Greenhills district was formed on an old road which runs straight downhill through the paddock. The slope varies from about 5 to 8% and falls towards the bottom of the photo. The gully is 6 feet deep in places and up to 8 feet wide on top. Photo—Govt. Printer.

"When the cost of gully control exceeds the value of the land protected, the work may not be justified unless it serves to protect adjacent land, reservoirs, waterways, buildings, bridges, highways or other downstream property. After a gully has eaten its way to the head of a watershed, activity usually ceases. If it is merely protected from livestock, volunteer vegetation generally will establish a suitable protective cover. *But when a gully starts advancing up a watershed slope, there is immediate necessity for employing intensive control measures.*"

Generally speaking then, gullies are to be avoided rather than controlled after they are formed. But there are already numerous gullies to be dealt with. It is important to remember in these cases, that gully reclamation depends firstly, on the same principles as control and prevention of water erosion generally. The most important thing is to absorb water where it falls on the watershed which has caused the gullying. In most cases, where gullies have already formed, measures such as improved pastures may be adequate to arrest gully erosion if a good stand of pasture, particularly with clover, can be established. Many cases are known in Western Australia where clover has not only stopped further gullying, but has enabled the gullies to heal in the course of a few years. (See Fig. 11.)

Fig. 11.—On this Northam farm pasture has stopped active erosion in these gullies which are gradually being healed. Cultivation will be continued on the hill top with contour bank protection, the steep hillsides will be retired to pasture and contour furrowed, and the slope in the foreground will be retained for cultivation by contour bank treatment. All working will be on the contour, and a longer period of pasture improved by subterranean clover will be included in the rotation. These gullies will then have been safely reclaimed The slope in the foreground is about 10% and falls towards bottom of picture.

Photo—Govt. Printer.

In gullied land where cultivation is to be continued, reclamation of gullies is unsound unless provision is first made to keep run-off out of them by diversion drains or systems of contour banks on the watershed which has caused the gullying. When this is done, even quite large gullies may be ploughed in with a disc plough in a few rounds, using 10 to 12 feet of chain and dropping the furrow wheel into the gully. It is fairly simple to make gullies crossable by big machinery for contour working between contour banks in this way, but unless such mechanical protection is given first, attempts at gully reclamation by ploughing-in are more likely to enlarge gullies than reclaim them. It must be admitted, however, that this depends on the circumstances in each particular case. Sometimes the ploughing-in of gullies, particularly if they are fairly small, is a fairly good risk after the first rains, but they should be seeded heavily and well fertilised as soon as ploughed-in. If this is done, the plants will hold the soil safely in a few weeks providing heavy rain does not wash out the loose soil before it is held by pasture or crop. In some districts and on some sites, this will be moderately safe, where

in other districts and other sites it would be almost certain to increase the trouble rather than overcome it. The chances can only be estimated on the spot, and local knowledge is desirable.

Other Gully Treatment.—Efforts to establish plant growth in gullies by hand planting of grasses, clovers, shrubs and trees are often worth while, especially in big V-shaped ones with sloping sides. Stock should be kept out where possible. Kikuyu grass and the weeping willow tree will be of value where there is summer moisture. *Paspalum vaginatum** is very promising for summer moist salt land gullies. Various native plants and weeds are also likely to be of use, and where plants have already started to grow in gullies, it is worth gathering seed and spreading by hand or transplanting. Local tea trees, rushes, and sedges are helping to prevent gully enlargement in some places.

The head of the gully needs attention first and should be sloped off to 1 in 5 or less, and seeded thickly. Bags of soil, wire and brush fences, mounds of soil seeded thickly, straw, stone or roots may then be used to block the gully lower down. Such obstacles to the flow of water are best kept quite low, about one foot high, and placed at close intervals down the gully. If successful and they silt up, the process can be repeated. It is a bad mistake to make obstacles too high as water will cut around or under them, or the overflow will cut big holes and destroy the work done.

Roads Can Cause Gullies.—Roads both inside and outside farms are good watersheds and unless run-off is diverted from table drains at close intervals, say every two to three chains, the concentrated run-off often starts gullies. (See Fig. 12.)

Fig. 12.—Gully formed by runoff from road in the Northam district. When water which runs off roads is not diverted frequently from table drains, it gains enough volume and speed to scour gullies. Photo- Govt. Printer.

* Small quantities of roots are available from the Department of Agriculture.

Road boards are usually eager to co-operate when this is pointed out to them. It is also in the farmer's interest to see that his own farming methods do not cause damage to roads.

SPECIFICATIONS FOR CONTOUR BANKS.

A. *The Absorption Type of Contour Bank* is for use on gentler slopes of up to three per cent. except in some special circumstances. Absorption banks are built level on a true contour and are designed to hold run-off water on the land till absorbed by the soil. They are not expected to be used much in the 15 to 25 inch rainfall areas.

B. *The Drainage Type of Contour Bank* is for leading run-off water safely from sloping lands. Drainage banks will probably be needed on most cultivated slopes of five per cent. to 10 per cent. in the 15 to 25 inch rainfall areas. Systems of contour banks of this type must have a suitable waterway into which the water they carry may be discharged and led safely into creeks or rivers. (See Fig. 9.)

Length of Banks.—The channel should not usually carry water in one direction for more than 1,600 to 1,800 feet (24 to 27 chains). By grading to run both ways from a suitable point the distance between waterways can be doubled safely.

Spacing.—Contour banks should be close enough to catch run-off from the area between banks before it gains volume and speed which could cause erosion.

For trial purposes, a vertical interval of ten feet has been used on demonstration experiments in progress. This means that each bank is ten feet lower than the bank above it, so that on a ten per cent. slope banks would be 100 feet (1½ chains) apart and on a five per cent. slope they would be 200 feet (three chains) apart. A few banks at 15 feet and 20 feet vertical intervals are also under trial.

For general purposes, spacing at a vertical interval of ten feet is recommended in the 15 to 25 inch rainfall zone. This means spacing of one and a half to two chains (100 to 130 feet, on steeper slopes of seven to ten per cent., and three to four chains (200-270 feet) on slopes of four to six per cent.

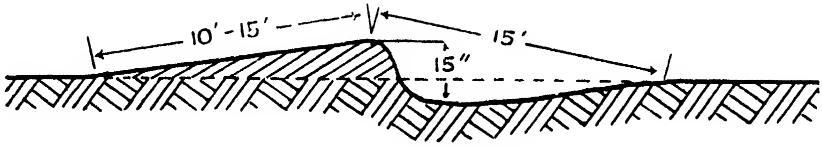
In practice, it is often necessary to vary the vertical interval up or down to avoid obstacles. Generally it is better to make the interval smaller. This applies especially to the interval from the top of the hill or drainage divide, to the top bank. If the top bank does not hold, the lower ones will almost certainly fail. Where banks cannot start at the hill top, an adequate diversion drain is needed above them.

Grades.—It is generally accepted that channel grades of more than four inches per 100 feet (0.3 per cent.) are seldom necessary or advisable. A variable grade increasing towards the outlet is commonly used. For example, a bank 1,600 feet long may be given a grade of one inch per 100 feet from the start to 400 feet, two inches per 100 feet from 400 to 800 feet, three inches per 100 feet from 800 to 1,200 feet and four inches per 100 feet from 1,200 to 1,600 feet at the outlet end: A total fall of three feet four inches in 1,600 feet.

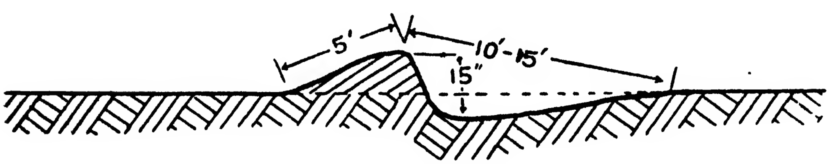
But grades like one inch in 100 *feet are suitable only for very even smooth slopes.*—On ground which is less smooth and even, the grade is better started at say two and a half inches per 100 feet (0.2 per cent.) and increased every 300 to 500 feet. In Western Australia, grades up to six inches per 100 feet (0.5 per cent.) have been used and are likely to be safe if the channel is kept well covered with grass and clover.

Where eroded areas are crossed, it is advisable for the grade to be say three inches per 100 feet (0.25 per cent.) or higher. Grades up to 18 inches per 100 feet (1.5 per cent.), have been used for experimental purposes, but are not generally recommended as they are likely to scour into gullies.

Size and Shape.—The bank should rise 15 to 18 inches above the bottom of the water channel which should be two to four feet wide on the bottom and six to 12 feet wide on top.



A



B

Fig. 13, A & B: Cross sections of contour banks recommended in W.A. (B) and S.A. (A).
B. shows a cross section of the type of bank recommended for W.A.
A.. Cross section of bank recommended in South Australia.

The type of bank recommended in Western Australia is shown in Fig. 13 B. and Fig. 15. This shape gives big water channel capacity and low construction cost. Disadvantages are:—

(i) Cannot be cultivated and may thus harbour weeds.

(ii) Cannot be seeded and out of every 100 acres on 5% to 10% slopes, three to seven acres would be lost for cropping. With a three to six year rotation on relatively low priced land, this does not appear serious.

(iii) Cannot be crossed by machinery or transport.

In Fig. 13A, the type recommended in South Australia is shown. The whole lower side of the bank can be seeded if made as wide as the combine in use on the farm.

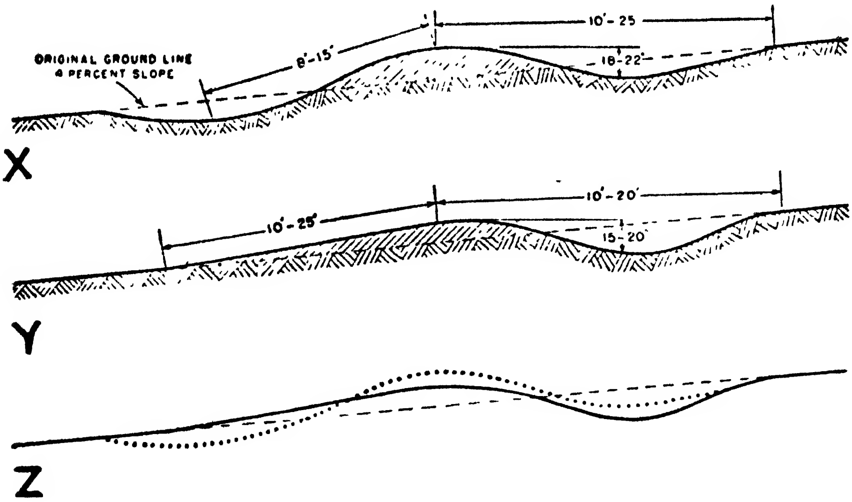


Fig. 14.—Sections of contour banks recommended in New South Wales and the United States of America. X shows the section of a bank built from both sides: Y when built entirely from the upper side and Z gives a comparison of banks built by the two methods.

Diagrams from U S.D.A. Farmers' Bulletin, 1789, 1943.

The broad based type of contour bank (called terrace in U.S.A.) recommended in New South Wales and the United States of America can be cultivated and cropped without any loss of area. But the cost of construction is higher (See Fig. 14.)

Fig. 15.—Contour bank in the Northam district on land sloping down from right to left. The upper tape is parallel to the ground and the lower tape is horizontal, showing a fall of about one foot in 25 feet, that is a four per cent. slope. The ridge of the bank is about 13 or 14 inches above the bottom of the water channel on the right. The ridge is not quite high enough and the channel should be wider.

Photo—Govt. Printer.

Machinery and Equipment.—Heavy disc and mouldboard ploughs, twin disc cultivator ploughs, grader-ditchers, and road graders, have all been used for bank building in Western Australia. Ploughs are more suitable for slopes up to 4%, and moist soil, but can be used on steeper slopes. Grader type equipment can be used to build banks entirely from the upper side on steep slopes. See Fig. 16. This is better and cheaper. Graders also work well with dry soil providing it does not powder. Smaller equipment of these types is readily available and suited to farm tractors. Scoops or grader-ditchers are needed to fill gullies where banks are to cross, before the bank is built. It has not yet been possible to test heavy modern earth moving machinery for contour bank building in Western Australia.

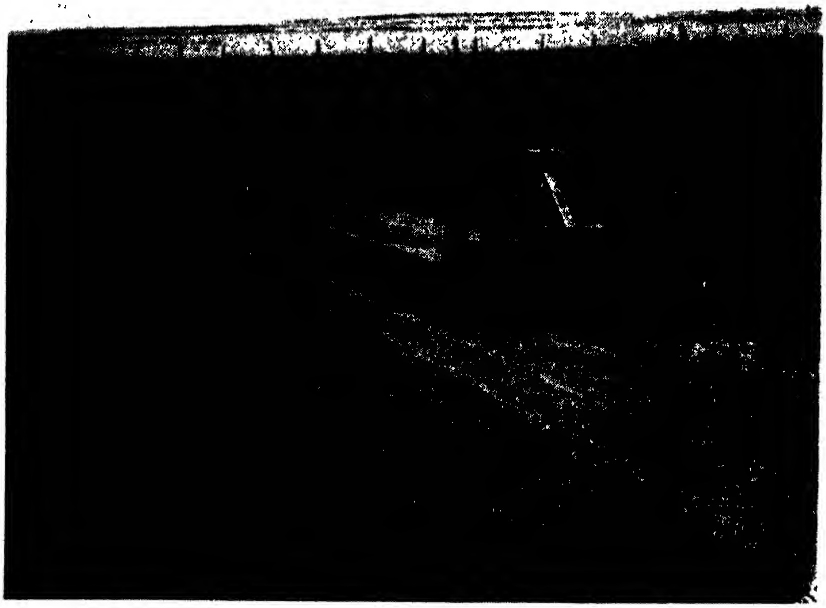


Fig. 16.—The grader-ditcher is useful for building contour banks. It is also valuable for pasture furrowing on slopes up to 15 per cent. This machine has a seven foot blade which is readily reversed to build contour banks entirely from above on steeper slopes.
Photo—Govt. Printer.

Waterways for Contour Bank Outlets.—Any area of land would be served by a group of banks. Such groups or systems of banks need one or more outlets which will serve to carry excess water safely to drainage lines or absorption areas. A strip of land about two chains wide and nearly level across, with the gentlest available slope downhill, is desirable, and may be safely used if well grassed. The waterways should be selected and, if possible, heavily seeded to pasture and well fertilised one or two years before contour banks are built. Suitable valleys with good natural grass are sometimes available. But in the areas where waterways are most needed, such sites are often already gullied and therefore unsuitable. (See Fig. 9.)

Construction of Contour Banks.—The top bank is built first and then succeeding ones downhill. If this were not done, lower banks built first are likely to fail in a storm during construction.

Cost of Contour Banks.—The cost of contour bank work varies greatly. The number and size of gullies to be crossed and reclaimed, the skill of the operator, the kind of country and the condition of the soil are the most important factors. Figures kept in Western Australia suggest that most contour bank work is likely to cost from 5s. to 15s. an acre.

HOW EFFICIENT ARE CONTOUR BANKS?

Contour banks can be almost 100 per cent. efficient in preventing water erosion. But they cannot do the job alone. If used on suitable areas and supported by land use adapted to the needs of each area, results will be very satisfactory. But if maintenance or any of the supporting practices are neglected, contour banks are likely to fail.

CONTOUR BANKS MUST BE SUPPORTED BY SUITABLE ADJUSTMENTS IN FARMING PRACTICE.

Storms.—Contour banks should not be expected to give protection against all storms. They could do this if made big enough and close enough together. But as this may mean construction and working costs out of proportion to the value of the land, it seems reasonable to take some risks and expect that at intervals damage to bank systems will occur from particularly severe rainstorms.

Flood Control and Soil Conservation.—Flooding results when too much water runs off high land too quickly for safe discharge by natural drainage channels.

The practices discussed for the prevention and control of soil erosion by water also lessen the danger of flooding. They have two main purposes, firstly, to absorb and use rain where it falls: secondly, when this is not possible, to slow down run-off and stop erosion. When appropriate soil conserving practices have been applied to the main parts of any single watershed, flood hazards due to that watershed will be greatly decreased.

CONTOUR BANKS IN W.A.

With contour banks, experience in Western Australia dates from 1941 so far as is known. It emphasises nine points, which are:—

1. The lines must be laid out with a level.
2. Contour banks put in by eye have failed in two known cases.
3. A carpenter's level used with an "A" frame as described in the Journal of the Department of Agriculture, W.A., September, 1938, will do the job satisfactorily. (See also Figs. 17 & 18.)
4. Satisfactory contour banks can be made with farm tractors and ploughs, grader-ditchers and road graders.
5. Working contour banked paddocks is not as awkward as expected.
6. The cost of contour banking is likely to vary from 5s. to 15s. per acre in most cases.
7. The results have more than justified the expense.
8. Farmers who have already used contour banks want more of them.
9. In the Northam district, one farmer seeing contour banks on a neighbouring farm, made an A frame level and has already designed, levelled and built, banks on five of his paddocks with horses and plough.

THE A FRAME LEVEL.

The pegging of lines for contour working and particularly for drainage type contour banks with varied grades, requires a suitable levelling instrument. If a surveyor's level is not available, the A frame can be made and will enable a carpenter's level to do the job. The A frame can be made of very light materials if suitably braced.

The following diagrams and description of the A frame are taken from the booklet "Soil Erosion and Its Control" published by the Rural Bank of New South Wales. (See Figs. 17 & 18.)

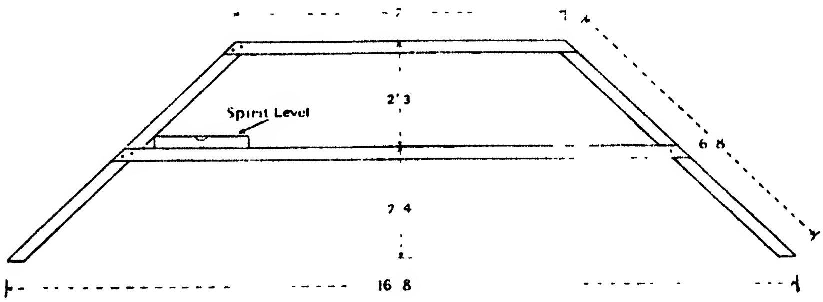
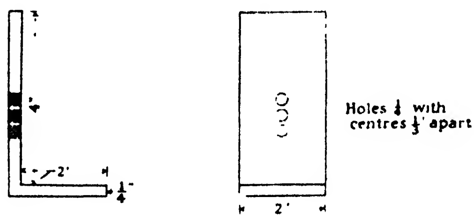
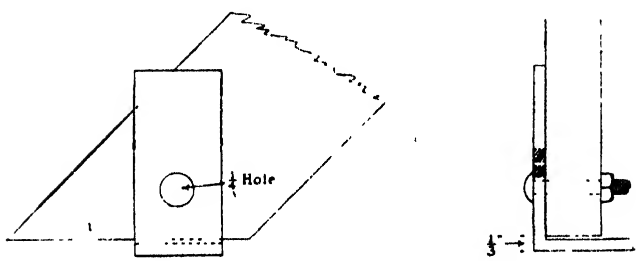


Fig. 17.—The A Frame Level
The carpenter's level is commonly used in the middle of the frame.



Adjustable Foot



Adjustable Foot bolted to leg

Fig 18.
Detail of A frame.

In construction, care must be taken to ensure that the spread of the legs is 16ft. 8in. (200in.) and the centre crosspiece is perfectly level when the legs are of equal length and the frame stood on a level floor.

This frame can be used for marking out level banks without any adjustment. For marking out variable graded banks an adjustable foot is attached to one leg so that it can be lengthened by ⅓in. at a time (⅓in. in 200in. = 2in. in 100ft.) so that grades can be fixed to 2in., 4in. and 6in. per 100ft.

A ¼in. hole is bored in one leg about 1in. from the foot, a piece of 2in. x ¼in. iron is bent to form an L. The first hole is drilled in it to correspond with the hole in the leg when the base of the L is ¼in. below the leg. Other holes are drilled ⅓in. apart along it.

Where 2in. fall in 100ft. is required the foot is clamped to the leg with a ¼in. bolt through the lowest hole, for 4in. fall in 100ft. through the second hole, and so on. (See Fig. 18.)

It should be tested before use and periodically while levelling.

To test the "level," set it up on a floor or smooth piece of ground so that the bubble of the spirit level is in the centre and mark the position of the lower ends of the legs. Then reverse the "level," end for end, placing the legs on the same spots. If the apparatus is in adjustment the bubble will still be in the centre.

NEW PUBLICATION: AUSTRALIAN JOURNAL OF SCIENTIFIC RESEARCH.

The Council for Scientific and Industrial Research, in collaboration with the Australian National Research Council, has established in Australia a new scientific journal, the "Australian Journal of Scientific Research," as a medium for the publication of research papers of outstanding merit. This journal is open to receive contributions from research workers, irrespective of country or of the organization to which they are attached.

Dr. N. S. Noble has been appointed as Editor of the new journal. Editorial policy is determined by an Editorial Board under the chairmanship of the Editor and comprising as members: Professor W. J. Dakin (Department of Zoology, University of Sydney), Professor E. J. Hartung (Department of Chemistry, University of Melbourne), Professor L. H. Martin (Department of Physics, University of Melbourne), and Professor J. G. Wood (Department of Botany, University of Adelaide). In order to maintain the journal at a high standard a strict refereeing system has been instituted.

The journal is printed in two series: Series A (Physical Sciences) and Series B (Biological Sciences). Each series is issued quarterly, the subscription being 30s. per annum. The first two numbers of each series have been issued, and inquiries and orders for the new journal should be addressed to the Secretary, C.S.I.R., 314 Albert Street, East Melbourne.

MOLYBDENUM FOR THE PREVENTION OF "WHIPTAIL" IN CAULIFLOWERS.

By T. C. Dunne and L. T. Jones, Plant Nutrition Branch.

The disorder of cauliflowers known as "whiptail" has been known for many years in Western Australia and, at times, has been particularly serious in some of the market gardens near Perth.

"Whiptail" plants are always stunted and are characterised by pale, distorted, ruffled leaves associated with a narrowing of the leaf blades (Fig. 1). All affected plants produce inferior grade flowers which may be small, open and unmarketable, even when the disease is only moderately severe.

The more severely affected "whiptail" plants become very badly stunted. The centre leaves fail to develop leaving only a button from which there is no further growth. Plants affected in this manner often develop adventitious shoots from those portions of the stems below ground level. (Fig. 2.)

In past years applications of lime have been recommended as a corrective for "whiptail." It has recently been suggested that lime, so used, is effective by virtue of its action in overcoming soil acidity, thereby increasing the availability of molybdenum which is known to be relatively insoluble under acid conditions. In this State, however, the disease is not confined to acid soils and heavy dressings of stable manure or organic wastes (20-40 tons per acre) sometimes have given better control. It is possible that the molybdenum contained in such added material suffices for the needs of a cauliflower crop.

Fig. 1.
A typical "Whiptail" plant.

Fig. 2.
A severely affected plant showing adventitious shoots from below ground level.

DISTRIBUTION AND OCCURRENCE.

"Whiptail" of cauliflowers is generally regarded as being a disease of acid soils but in Western Australia it has regularly been observed on soils which are alkaline. It can occur, for example, on the orange coloured tuart sands which have pH values ranging to 8.2 and on the calcareous loams at Coogee which contain as much as 70% calcium carbonate and have pH values ranging to 8.6.

It is true, however, that severe losses have been experienced on peaty swamp soils (pH 4.2-5.8) on sections of which attempts to raise cauliflowers have been abandoned. Here, however, the losses may have been accentuated by the fact that these areas did not receive the heavy dressings of stable manure (up to 20 tons per acre) which are usually applied to the neighbouring sands and which, as mentioned above, may provide reasonable amounts of molybdenum.

In addition to occurring on the above soils, severe "whiptail" has also been noted on the gravely loams of the Darling Range and on the loamy sands of the Mooliabeenie area. Here again, it may be significant that dressings of stable manure are not normally used.

Disease symptoms may become apparent when the plants are in the six to eight leaf stage and there is evidence that it is accentuated by dry soil conditions. Early sown affected plants which are, because of insufficient moisture, making slow growth, may develop normal leaves after the advent of good rains and eventually produce marketable flowers.

There is a difference in varietal susceptibility. The quick growing, early maturing varieties are usually most severely affected but on certain soils some of the later varieties are equally unsatisfactory.

MOLYBDENUM AS A FACTOR.

In 1945 Mitchell (3) in New Zealand reported success in controlling "whiptail" by the use of a molybdenum containing compound (ammonium molybdate). Rates of 1lb., 5lb., and 20lb. per acre were applied along the lines of planting a week before the plants were set out. Symptoms failed to appear, though growth was not vigorous, with the application of 1lb. per acre and virtual control of the disease was effected with a dressing of 5lb. per acre. On the other hand, heavy dressings of lime applied just prior to planting were of no benefit.

Since that time it has been shown in New South Wales (4) that "whiptail" was almost completely controlled by dressings of 1lb. per acre of sodium molybdate but that an application of ¼lb. per acre was insufficient.

Carefully controlled work by Hewitt and Jones (1) has demonstrated that "whiptail" of cauliflowers can be developed by withholding molybdenum from the nutrients supplied to plants and that only extremely small quantities of that element are necessary for normal growth.

A review of the literature shows, therefore, the definite relationship of molybdenum to the disorder. Further, it can be safely concluded that the occurrence in cauliflower of "whiptail" symptoms is due to an insufficient supply of molybdenum for normal plant growth.

EXPERIMENTS IN WESTERN AUSTRALIA.

Osborne Park Area.

Friable peaty soil—pH 4.6-pH 5.0.

In 1945 Jones (2) observed that "whiptail" symptoms did not develop on plants receiving a fertiliser mixture containing magnesium, manganese, copper, zinc, boron and molybdenum (as molybdenum trioxide at 1lb. per acre) whereas many affected plants occurred in nearby plots not receiving that mixture. No further attempt was made to determine the element or elements responsible for the effect.

In February, 1948, following on the successful New Zealand work, an attempt was made to determine the value of molybdenum for "whiptail" control on the same soil type. For this purpose the following treatments were used:—

A—Control.

B—Sodium molybdate, pure—2lb. per acre.

C—Molybdenum trioxide (roasted molybdenite)—2lb. per acre.

D—Slaked lime—1 ton per acre.

The molybdenum content of the sodium molybdate was about 40% and of the molybdenum trioxide was about 55%.

The materials for the treatments were mixed with a fertiliser mixture containing superphosphate, sulphate of ammonia and potash, which was used at the rate of about 15cwt. per acre. The mixtures were placed near the planting holes when the plants were set on March 2nd. There were four plots of each treatment, each plot consisting of 16 plants.

Unfortunately autumn rains were very late, and although some soil moisture was available, the plants developed very irregularly. By the time sufficient rain fell for normal growth, the growth of the plants within each plot was very variable and these initial differences persisted. It was therefore impossible to make an accurate analysis at harvesting which took place over an extended period.

It was noted, however, that irrespective of treatment, all plants developed "whiptail" in the early stages. This condition persisted until most of the plants were over one foot tall when there were indications on new leaves that the molybdenum might be having a beneficial effect.

Three months after planting, however, it was apparent that the new growth of the plants which received molybdenum was smooth, healthy and of normal appearance. These plants continued to improve and a satisfactory crop was obtained.

The final inspection showed that both sodium molybdate and molybdenum trioxide had been eventually completely effective in eliminating "whiptail" symptoms from the later growth. Except for one small corner of the area, the control plants were all severely affected. Lime had no beneficial effect.

Typical plants from this area are shown in Figures 3 and 4.

Fig. 3.
Plants without molybdenum.

Fig. 4.
Plants which received sodium molybdate.

Mooliabeenie Area.

In June, 1948, an area was inspected at Mooliabeenie where a large number of cauliflowers were severly affected with "whiptail." Seasonal conditions had been dry until a few weeks prior to the inspection.

Plantings had been made over a period of time so that various blocks were in different growth stages. An investigation was therefore begun to determine—

(a) the minimum quantity of molybdenum for field use.

(b) the most forward growth stage at which molybdenum could be used to ensure recovery of affected plants.

For the experiments a commercial line of sodium molybdate was used. This material contained only about 45% sodium molybdate, the remainder being mainly sodium nitrate. The treatments used were:—

	Commercial sodium molybdate gms. per plant	=	approx. lb. per acre.
A	Nil		Nil
B	0.2		2
C	0.4		4
D	0.8		8
E	1.6		16

The molybdenum was used mixed with a superphosphate dressing of approximately 100lb. per acre. It was applied near the bases of the plants in holes which were filled in after the application of the manure. The control plants received only superphospate at this time. All treatments were carried out on June 30.

Site 1.

Plants at 12-16 leaf stage and 1-2ft. tall. They had been transplanted on March 9.

Soil—very gravelly loamy sand—pH 57—pH 6.2

The plants in this group were showing severe "whiptail" symptoms. Each treatment was applied to one row in which were about forty plants.

With the advent of increased soil moisture, some improvement occurred with all plants but there was no diminution of the severity of the symptoms with any treatment.

It appears that at the stage of growth at which molybdenum was applied to these plants, it is too late to bring about commercial recovery.

Site 2.

Plants at 6-8 leaf stage and about 8in. tall. They had been transplanted about mid-May.

Soil—sandy loam and gravelly sandy loam—pH. 5.0—pH 6.1.

Two rows each of about forty plants were used for each treatment.

Growth of all plants had ceased about two weeks prior to the application of the treatments and a number of the plants were showing "whiptail" symptoms.

Careful inspection a month later indicated that new growth was occurring at the centres of the plants receiving molybdenum but this was not the case with the control plants. Three weeks later, i.e., seven weeks after treatment, the differences in growth due to the use of molybdenum were obvious.

A final survey of the experiment was made in early October, at harvesting time. The following data were obtained on the incidence of "whiptail" and on the quality of the flowers produced.

Treatment.	Commercial Sodium Molybdate Rate per Acre.	Per cent. "whiptail" Plants.	Per cent. Marketable Flowers.		
			Grade 1.	Grade 2.	Grade 3.
A	*Nil*	97	*Nil*	*Nil*	2
B	2 lb.	1.0	63	10	14
C	4 lb.	*Nil*	53	15	13
D	8 lb.	*Nil*	60	14	12
E	16 lb.	*Nil*	57	13	21

The results show that sodium molybdate, as used in this experiment, on plants at the 6-8 leaf stage, was successful in controlling "whiptail" and in producing a marketable crop. It was also shown that the use of higher rates than 2lb. per acre of commercial sodium molybdate was not necessary. There was no evidence of injury at the higher rates used.

Figure 5 shows typical plants of adjoining rows in the experiment.

Fig. 5.

Plant on left—Commercial Sodium Molybdate 0.4 gm.=4lb./acre.
Centre plant—Commercial Sodium Molybdate nil.
Plant on right—Commercial Sodium Molybdate 1.6 gm.=16 lb./acre.

Site 3.

Plants at 4-6 leaf stage and 6in. tall. Transplanting had been done on June 8.

Soil—loamy sand—pH. 5.5—pH 5.7.

The plants of this group were, at the time of application of the mixtures, just beginning growth. The treatments were each applied to two rows, each of about twenty-five plants.

On this area severe whiptail occurred only on one end of the rows where the soil included more gravel. However, as with the previously reported trial, the first signs of benefit from molybdenum were noted about a month after treatment and these effects were quite obvious a month later.

Before the flowers were mature the plants began to suffer from drought so that maximum growth was not attained. The following data were obtained from a survey made on October 29:—

Treatment.	Commercial Sodium Molybdate Rate per Acre.	Per cent. "whiptail" Plants.	Per cent Marketable Flowers.		
			Grade 1.	Grade 2.	Grade 3.
A . .	*Nil.*	33	2	11	43
B ..	2 lb.	*Nil.*	10	32	30
C	4 lb.	*Nil.*	6	40	32
D	8 lb.	*Nil.*	12	46	23
E ..	16 lb.	*Nil.*	10	47	22

The results again show the effect of the sodium molybdate in eliminating "whiptail" and in improving the commercial value of the crop.

General Field Results.

Because of the wide-spread nature of the disease of this Mooliabeenie property, the owner was supplied with sufficient crude sodium molybdate to treat the plants not included in the experiments reported above. An arrangement was made whereby every twentieth row was not to receive the molybdate.

In accordance with this arrangement, commercial sodium molybdate was applied with sulphate of ammonia, the mixture being placed in holes near the plants. More than 10,000 plants were treated.

The results were in keeping with those obtained experimentally, the younger plants treated developing free from abnormality whereas the control rows showed 90 to 100 per cent. "whiptail" with few marketable flowers.

RECOMMENDATIONS.

For the control of "whiptail" in cauliflowers it is therefore recommended that growers use molybdenum, which is obviously essential to healthy growth.

Molybdenum can be obtained in a readily soluble form as commercial sodium molybdate which contains about 45 per cent. actual sodium molybdate. This should be applied at the rate of 2lb. per acre mixed with the usual fertiliser dressing. Application should be made close to the plants at the time of planting or shortly thereafter.

Molybdenum trioxide (roasted molybdenite), which is less soluble, has also proved effective on very acid soil but has not been yet tested as extensively as sodium molybdate.

Although lime was not used in sufficient quantity to neutralise all acidity in the Osborne Park peaty soil, the method of placement should have created a limited area of alkalinity. In spite of this, insufficient molybdenum became available to benefit the plants. It is therefore recommended that attempts to control the disease by liming be discontinued in favour of manuring with sodium molybdate.

ACKNOWLEDGMENT.

Mr. A. Guelfi of Osborne Park and Messrs. R. Kukura and L. O. C. Thompson. of Mooliabeenie are thanked for their help in obtaining the data reported above.

SUMMARY.

"Whiptail" of cauliflowers occurs in Western Australia on a variety of soil types. It has been observed regularly on both acid and alkaline soils.

It has been shown elsewhere that the disorder results from a deficiency of molybdenum and that it can be prevented by manuring with molybdenum compounds.

Local experiments show that commercial control can be achieved by the use of molybdenum in various forms. It is also shown that "whiptail" plants up to the 6-8 leaf stage can develop normally following manuring with a commercial sodium molybdate. Success in curing affected plants in a more advanced growth stage is doubtful.

Lime used at the rate of one ton per acre placed near the plants did not control the disease on a very acid soil.

Recommendation is made that for control of "whiptail" use be made of a commercial sodium molybdate, containing about 45% of the effective salt, for application at the rate of 2lb. per acre.

REFERENCES.

1. Hewitt, E. J., and Jones, E. W.: "The production of molybdenum deficiency in plants in sand culture, with special reference to tomato and Brassica crops." Jour. Pomol and Hort. Sci. 23, 254-262, 1947.

2. Jones, L. T.: "Is blood and bone manure essential for vegetable growing under Perth metropolitan conditions?" Jour. Dept. Agr. West. Aust. 22, 173-190, 1945.

3. Mitchell, K. J.: "Use of ammonium molybdate to control 'whiptail' in cauliflower and broccolli crops." N.Z. Jour. Sci. and Tech. 27, 287-293, 1945.

4. Waring, E. J., Shirlow, N. S., and Wilson, R. D.: "Molybdenum in relation to 'whiptail' of cauliflower." Jour. Aust. Inst. Agr. Sci. 13, 187-188, 1947.

UREA FEEDING TRIAL—DENMARK, 1947.

By V. WESTON, Manager, Denmark Research Station.

A recent innovation in the field of animal nutrition is the use of urea as a substitute for a part of the protein needs of the animal. In America during the war it was extensively used in concentrate mixtures to supply portion of the protein requirements of dairy cows.

Urea is a white crystalline synthetic compound which looks very much like salt, and tastes a little like epsom salts. It contains approximately 42 per cent nitrogen and, therefore, has a protein equivalent of 262 per cent. It thus has nearly seven times as much nitrogen or protein equivalent as soybean meal, or over ten times as much as linseed meal, containing 25 per cent. protein equivalent.

However, unlike the oil meals or other protein concentrates urea does not contain any carbohydrates, fats or minerals. Therefore, it needs to be "built up" in this respect by mixing it with grains like wheat and oats to give a mixture comparable with linseed meal. For example 34 lb. of linseed meal is equivalent to 3 lb. of urea plus 31 lb. of oats.

Experimental results overseas show that urea is safe and efficient as a protein substitute when it supplies approximately one-third of the total crude protein in the concentration ration fed to the ruminant, but if fed in high concentrations can be toxic.

Urea cannot be used satisfactorily with non-ruminants.

The following urea feeding trial at Denmark Research Station was designed to—

(a) Compare the results obtained from feeding the farm concentrate ration (ration A) with results from the same ration to which up to three per cent. of urea had been added (ration B). Ration A contained less than the optimum amount of protein, due to shortage of protein meals.

(b) Compare the results obtained from feeding ration B and a third ration in which the linseed meal or a linseed meal concentrate had been incorporated to supply an adequate level of protein

The experiment covered a period of four months.

Three groups of three cows were selected from the herd. Selection was based on past available butter fat records, age and number of previous calvings. Groups were made as even as possible to enable a reasonable comparison of average results.

One group of cows was used as a control group—and fed on ration (A) for the entire period. The other two groups were fed alternately on the urea ration (B) and the linseed ration (C) for monthly periods.

Denoting the three groups of cows as group 1, group 2 and group 3, respectively, this may be shown as follows:—

1st Month	1 A	2 B	3 C
2nd Month	1 A	2 C	3 B
3rd Month	1 A	2 B	3 C
4th Month	1 A	2 C	3 B

The milk from each of the nine cows was weighed and recorded night and morning.

Butter fat tests were carried out at monthly intervals.

Details of the rations are as follow—

RATION A:

50 lb. crushed wheat	4.35 lb. protein
40 lb. crushed oats	3.34 lb. protein
10 lb. linseed meal (25%P)	2.50 lb. protein
	10.19 lb. protein

RATION B:

50 lb. crushed wheat	4.35 lb. protein
40 lb. crushed oats	3.34 lb. protein
7 lb. linseed meal	1.75 lb. protein
3 lb. urea	7.86 lb. protein
	17.30 lb. protein

RATION C:

25 lb. crushed wheat	2.175 lb. protein
25 lb. crushed oats	2.085 lb. protein
50 lb. linseed meal (25%P)	12.500 lb. protein
	16.760 lb. protein

Unfortunately it was not possible to have analyses made of the mixtures and the protein values had to be calculated from standard tables.

Three and a half lb. of the above mixtures were fed per gallon of milk produced daily. The quantity was adjusted monthly.

The maintenance ration was uniform for the whole herd and consisted of:—

Prior to March 21, 1947	Dry pasture feed and 8 to 10 lb. long green maize daily per cow.
To April 21, .. 1947	Dry pasture—sparse. 8 to 10 lb. of long green maize daily.
To May 21, .. 1947	No maize, but short green pasture, clover and rye grass.
To June 21, .. 1947	Short green pasture—clover and rye grass 4 to 5 lb. meadow hay.
To July 31, .. 1947	Short green pasture—clover rye grass and 4 to 5 lb. meadow hay.

The table shows the total and average milk and butter fat production for the three ration groups.

Observations.

Some cows did not like the flavour of the urea, and in consequence would not eat the mixture at first. For these the quantity was reduced and later gradually increased.

The urea caused scouring for some days amongst most of the cows until the system became adjusted.

Some were not upset in any visible way. Others appeared to relish the mixture and always looked for more, although at times affected by scouring or indigestion.

General impression was that three per cent. urea in the concentrate mixture was too strong.

Feed changes were too sudden from one ration to the other, often contributing to indigestion. There was no visible loss or gain of weight or condition on any ration.

All cows were otherwise healthy except for the control group during the last 14 days.

Discussion.

From the tables it will be noticed that the control group fed ration A (low protein content) maintained a very even production throughout.

Extreme fluctuations are absent. Sickness during the last 14 days caused a fall in production and slightly greater daily variations.

The B and C ration groups show a greater tendency toward daily variations in production.

Ration C gave slightly higher production.

Table of total and average production of three groups:—

	Total Milk lb.	Average Milk Per Day lb.	Butterfat Average Per Day lb.	Butterfat Total lb.
Ration A	6,460	52.5	3.39	417.16
Ration B	6,466	52.2	3.44	423.29
Ration C.	6,715	54.5	3.72	458.18

There is little or no difference between rations A and B. The indication is that the urea gave no increased production.

Ration C containing the extra linseed protein gave an increase of 3.9 per cent. of milk and an increase in butterfat of 9.8 per cent. over ration A and 8.2 per cent. over ration B.

Ration	A.			B.						C.					
Name of Cow ...	Denmark Golden Dawn.	Denmark Velveteen.	Denmark Rosemary II.	Denmark Angeline.	Denmark Reflectionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Standard's Dawn.	Denmark Angeline.	Denmark Reflectionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Standard's Dawn.
Date.															
March 21 ..	21	15	14	26	18	17½							22	29½	13½
March 22 ..	22½	15	14½	22½	19½	16½							22½	27	14½
March 23 ..	20½	18	16	23	18½	16							20	25½	11½
March 24 .	19	18½	13½	23	16	17½							19	26	13½
March 25	20	18½	15	25½	16	16							22	26	12½
March 26 .	21	17½	12½	23	17	16							22	29	15
March 27	19	23	12½	19	17½	17							21	27½	14
March 28	21	23½	13	25½	19	17							25	26½	16
March 29	20	26½	10	23	18	15½							23½	28½	15
March 30	21½	24½	12	21½	18	16							23½	27	14
March 31 .	19	26½	12½	21½	15½	15							24	27	13½
April 1 .	19	24	11	23½	17	17½							23	26	14
April 2	19	23½	12½	16½	21	16							23½	29	15
April 3	19½	24	12½	19½	17	14½							23	20	13
April 4	20	25	13½	21	16½	16							23	28	14
April 5 .	18½	24	9½	16	16	15							24	27	11
April 6	17	22	13	21½	20	14½							24	25	18
April 7 ..	17	19	13	19	16	14							13½	21	10
April 8 ..	18½	21	14	19	15	14½							18	22	10
April 9 .	18	24½	14	19½	16	15½							20	24	13
April 10 ..	18	25	15	19	14½	15							20½	23	12
April 11	17	23	12	20	17	14½							20½	24	10
April 12 ...	19	23½	15	19	16½	15½							21½	26	8
April 13 ..	19	25	13	16½	14	14							20½	27½	14
April 14 .	19	25	14	22	18	14							19	26½	5½
April 15 .	19½	24½	13	20	18	17							24	26	12½
April 16 ..	19½	24	12½	24	17	18½							22	26½	12
April 17	19	24	16	22	17½	14½							21½	26½	12
April 18 ..	19	25	16½	20	17½	18							24	25	13
April 19	18	25	14½	23	18½	19							23	25½	15
April 20	18½	24	15½	22	18½	18							21½	25	13
April 21 ...	18	24	15½	25	18½	19							23	28	15
Morning Weight	11	15	9	14½	11	10							16	17	7
Morning %	6.5	6.0	5.5	5.6	4.8	4.9							4.8	4.8	4.0
Evening Weight	8	9	7	11	8	9½							8	12	6
Evening %	6·4	7·2	7·8	6 1	7 2	8.2							5.8	6.7	5.8
Butter Fat %	1.227	1.548	1.041	1.482	1.104	1.269							1.216	1.620	.628

Ration	A.			B.						C.					
Name of Cow	Denmark Golden Dawn.	Denmark Velveteen.	Denmark Rosemary II.	Denmark Angeline.	Denmark Reflectionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Standard's Dawn.	Denmark Angeline.	Denmark Reflectionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Standard's Dawn.
Date.															
April 22	20	21½	15½				21	28	13	23	19	17½			
April 23	18	23½	15				22	27	13½	22½	20	18½			
April 24	19½	23	14				21	28	14	24	20½	17			
April 25	21	22½	15½				19	26	13	21	21	16			
April 26	19	24	12				21	23	12½	24	22	19½			
April 27	19	23	16				20	25½	12½	24	21	17			
April 28	20	25½	15				19½	27½	13½	24	21	15			
April 29	19	25½	15				19	27	14½	23½	21	18			
April 30	18	23½	16				19	27½	13	24	21	18½			
May 1	19	23	14½				20	27	15	23	22	16½			
May 2	18½	24½	17				20	25½	14	25	21	19			
May 3	19	20½	15				23	23	14	23½	22	18½			
May 4	19	23	16				21	26	15	20	21	16			
May 5	18	22	14½				20	26½	14	26	18	12			
May 6	17½	22	12				18½	26	14	14	20½	18			
May 7	18	22	14				14½	25	15	21	18	15			
May 8	17	22½	13				17	25½	13½	17	15	16			
May 9	17	21½	12½				17	24	14	20½	21½	16½			
May 10	17	19½	13½				18	25	13	19½	17	15			
May 11	18	23	13				19½	28½	15	19	17	18			
May 12	16½	22½	14				19	25	11	22	19	17			
May 13	17½	23½	14½				17	27	14	20½	20	18			
May 14	17½	26	14				16	25½	13	21½	22	17			
May 15	17	23	14				17	24	13	20½	20	20			
May 16	17½	23½	14				16½	23	13	20½	20½	18			
May 17	19½	24	14				17	22	14	20	19	18			
May 18	17½	24½	14				23	18	12½	21	19	20			
May 19	15	23	15				22	13½	13	23	17	14			
May 20	19½	25	14½				18	15	13	19	23	22½			
May 21	18	23	13½				16	12	14	22	20½	17			
May 22	18½	26	14½				18	9	13	21	20	20			
Morning Weight	9½	14	8				11	6	7½	11½	11	11			
Morning %	6·0	5·2	7·6				5·0	3·4	7·0	4·8	6·0	6·0			
Evening Weight	8	14	7				6	3	6	10	9½	9			
Evening %	6.6	5.0	9.1				5·2	6·4	8·3	7·9	8·0	7·8			
Butter Fat %	1.098	1.428	1.245				·862	·396	1·023	1·342	1·420	1·494			

Ration	A.			B.						C.					
Name of Cow ...	Denmark Golden Dawn.	Denmark Vel-veteen.	Denmark Rosemary II.	Denmark Angeline.	Denmark Reflec-tionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Stand-ard's Dawn.	Denmark Angeline.	Denmark Reflec-tionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Stand-ard's Dawn.
Date.															
May 23	16	24	11½	19	17½	18½							17	16	14
May 24	18	22	12	18	14	16½							18½	19	11
May 25	16	22	13	19	17	18½							20	18	7
May 26	17	21	13	18	16	16½							20	17	8½
May 27	17½	22	11½	15½	16	18							21½	20	10
May 28	16½	22	12½	17	19	16½							19½	20½	8
May 29	16	23	12½	16½	17	16							21	24½	8
May 30	17	21	13	18½	14	19							20	22	10
May 31	16	21½	14	17	18½	18							21	23½	12½
June 1	18½	22	14½	18	17	18							20	22½	13
June 2	17	21½	16	17	18½	16							20½	24½	12½
June 3	17	21	13	17½	16	17							19	23½	11½
June 4	14	22	13	18½	17	15							19½	23½	11½
June 5	18	22	15	18	15	18½							16	24½	10
June 6	17½	21½	14½	16½	15	13½							18	25	5½
June 7	16½	21	15	17	17	16½							19½	24	9
June 8	16½	23	14	18	16	17							19	21	7
June 9	17½	20½	15	18½	17	15							19½	23	7
June 10	19	20½	14	16	15	17½							18	24	10
June 11	18	22	12½	15½	16½	18							17	26	8
June 12	18	23	14½	16	14½	17							18	25	8½
June 13	18	25½	14	16½	17	14½							18½	25	8½
June 14	18	20½	15½	17	12	20							18	25	6
June 15	19	21½	15	16½	20	17							20½	25	6
June 16	17½	23	13	19½	17	18							18	27	8
June 17	15	21	14	15	16	19							19	26	10½
June 18	17	22	14½	16	15½	20							22	24½	11
Morning	17½	21	15	14	18	19							19	24½	11
Evening	10	11	10	8	10	11							11	13½	6
Weight %		3.6	7.2	5·1	5·5	6·4							5·2	4·5	6·0
%	6.9	.10	6	6	8	9							8	11½	5
Butter Fat %	1 013	1.166	7.0	7·5	7·5	9·5							5·2	6·0	7·1
				·858	1·150	1·559							·988	1·298	·715

Ration	A.			B.						C.					
Name of Cow.	Denmark Golden Dawn.	Denmark Vel-veteen.	Denmark Rosemary II.	Denmark Angeline.	Denmark Reflec-tionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Stand-ard's Dawn.	Denmark Angeline.	Denmark Reflec-tionette.	Denmark Acette.	Denmark Briar Rose.	Denmark Diana.	Denmark Stand-ard's Dawn.
Date.															
June 20	17	20½	14	..	..	..	18	24	9	14	16	17	..	..	..
June 21	17	21	15	..	..	..	15	25	11½	20	19	19	..	..	..
June 22	16½	23	13½	..	..	..	16	25½	12½	15	20	19	..	..	..
June 23	16½	21	14½	..	..	..	16	25½	10	15½	18½	17	..	..	..
June 24	19	20	12	..	..	..	17	21	11	16	17	20½	..	..	..
June 25	16½	22	15	..	..	..	17	24	10	15	18	20	..	..	..
June 26	17	20	14	..	..	..	14	22½	9	12	17	17	..	..	..
June 27	18½	20	13	..	..	..	14½	19½	8	14	18	15	..	..	..
June 28	15½	21	15	..	..	..	15	22½	10½	10	18½	12	..	..	..
June 29	18	19	15	..	..	..	16	22	8	13	16½	15	..	..	..
June 30	15	21	14	..	..	..	15½	22	9	14	19	14	..	..	..
July 1	18	21	15	..	..	..	14½	24	12	14	18½	17	..	..	..
July 2	17	19	12	..	..	..	14	24	10	13	16	18	..	..	..
July 3	18	20	13	..	..	..	16	21	11	13	12	17	..	..	..
July 4	16	16	15	..	..	..	17	24	10	15	18	15	..	..	..
July 5	16	16	12	..	..	..	13	23	11	15	16	16	..	..	..
July 6	17	24	13	..	..	..	15	21	10	15	15	18	..	..	..
July 7	16	12	12	..	..	..	15	23	10	14	16	16	..	..	..
July 8	16	16	12	..	..	..	13	22	13	14	15	16	..	..	..
July 9	16	16	9	..	..	..	15	22	12	15	16	16	..	..	..
July 10	15	15	14	..	..	..	14	20	12	15	16	17	..	..	..
July 11	15	14	13	..	..	..	14	18	11	15	13	14	..	..	..
July 12	15	12	10	..	..	..	13	18	11	13	16	16	..	..	..
July 13	16	16	11	..	..	..	10	19	11	17	15	16	..	..	..
July 14	19	15	11	..	..	..	15	20	11	14	16	18	..	..	..
July 15	14	9	13	..	..	..	14	22	12	14	16	16	..	..	..
July 16	15	13	11	..	..	..	14	20	12	14	15	18	..	..	..
July 17	15	8	12	..	..	..	13	19	9	14	14	16	..	..	..
July 18	15	13	12	..	..	..	14	22	12	14	14	16	..	..	..
July 19	16	15	12	..	..	..	14	21	12	15	15	15	..	..	..
July 20	16	11	14	..	..	..	13	23	9	14	15	14	..	..	..
July 21	16	15	12	..	..	..	14	24	11	16	15	20	..	..	..
Morning } Weight	9	9	7½	..	..	..	7½	13½	7	9½	9½	12	..	..	..
Morning } %	5 2	6.4	6 6	..	..	..	4 4	5·5	5·5	5·3	5·7	6·6	..	..	..
Evening } Weight	6½	5½	4	..	..	..	7	11	4	6	6	10	..	..	..
Evening } %	6 8	6 8	7 7	..	..	..	6·8	7·3	6·8	6·2	7·4	9·4	..	..	..
Butter Fat %	.910	.950	.803	..	..	..	·806	1·546	·657	·876	·986	1·732	..	..	..

SOIL TYPES OF THE MARGARET RIVER DISTRICT.

By ROBERT SMITH, Senior Research Officer.
Division of Soils, Council for Scientific and Industrial Research.

INTRODUCTION.

THE immediate aim of the soil survey is to delineate the soil types of a district. The soil type is the basic and indivisible unit in soil classification which corresponds to the species of botany and biology. Each soil type is an individual which is characterised not only by the surface layer but by the combined characteristics of the soil profile extending downward to a depth of several feet. The expression "soil profile" is used to describe the succession of soil layers or horizons that can be observed in a pit or road cutting. The upper layers from which materials such as clay, lime and soluble salts have been leached is known as the "A" horizon whereas the sub-soil zone where clay and other substances accumulate is called the "B" horizon. Below the "B" horizon lies the parent rock or "C" horizon. Each main horizon may be further subdivided into sub-horizons as A_1 (darkened by organic matter), A_2 (light coloured layer), B_1, B_2, etc.

In the agricultural use of land each soil type behaves in an individual way. Soil types which lie together in the same field may react quite differently to the ordinary farm operations. Every farmer, for instance, is familiar with the variations in drawbar pull experienced in the basic farm operation of ploughing. This individual reaction of different soil types is felt in all phases of agriculture, including for example, the complex fields of plant and animal nutrition. It is obvious, therefore, that if the agriculturist is to make full use of the land he must possess a working knowledge of the characteristics of the local soil types. The purpose of this article, then, is to describe in some detail the main soil types of a district where soil surveys have already been carried out. The field descriptions of the soils of the Margaret River district are supplemented by chemical analyses and by observations of agricultural properties. The author hopes that the accumulation of further knowledge of the properties of these soils will be a continuous process in which all agriculturists—farmers, extension and research workers—will play a useful part.

THE MARGARET RIVER DISTRICT.

The Margaret River district lies in the extreme South-Western corner of the State in the zone receiving more than 40 inches of rain per annum. The native vegetation consists of sclerophyll forest of which jarrah (*Eucalyptus marginata*) and marri (*E. calophylla*) are the dominant species. Agricultural use of the land, which is comparatively recent, is confined to the forested inland belt. The coastal limestone hills, forming a zone approximately three miles wide, are used only for rough grazing. Farms are located in groups on the better forest soils. Large areas of undeveloped land separate groups of farms so that the pattern of development is patchy. The farms themselves are still far from full development. In a recent farm survey of the area Rowley (1946) shows that on the average a third of every holding remains uncleared. This author also gives the effective size of holdings as 100 acres of sown pasture. She ranks farm enterprises in the

Figures 1 and 2.—A farm in process of development at the Nillup settlement The soil type is Mungite sandy loam. It is late summer and the tufts of dry grass can be clearly seen. Standing dead timber is a feature of paddocks in this settlement.

following order of importance:—Butterfat, pigs, cull cattle, potatoes, poultry and apples. Production is based on the grazing of annual pastures of which subterranean clover is the chief constituent. This type of pasture produces a great bulk of feed in the spring but dries off in the summer and the amount of grazing is greatly reduced in late summer and autumn. Production, as a consequence is markedly seasonal. In terms of pounds of butterfat produced per acres of sown pasture, Roberts (1945) gives an approximate average figure of 54lbs. of butterfat per acre per annum.

Peculiarities of soils and climate are responsible for a number of agricultural problems. The leached nature of the soils has resulted in a series of mineral deficiencies for ordinary agricultural crops. After the initial gross phosphate deficiency had been overcome subterranean clover pastures flourished for a number of years. A deficiency of copper which soon appeared, however, resulted in failures of oat crops and "stalling" of subterranean clover and the replacement of these species by others with a lower copper tolerance (Jones and Elliott, 1945). The copper deficiency in the soil resulted in low copper intake by plants; the grazing cattle developed "falling disease," a condition due to copper deficiency in the grazing animal (Bennetts and Hall 1939, Bennetts 1941). This condition has since been overcome by the general application of copperised superphosphate in the Margaret River district. It is possible that further mineral deficiencies will appear in this area before an equilibrium is reached between farming practices and the soil environment. Jones (1948) reports a suspected case of potash deficiency on sandy soils in the Karridale area. The work of Carroll (1944) on the mineralogy of some soils from these districts shows a lack of variety among the heavy minerals, and further minor element deficiencies may develop as agriculture is intensified.

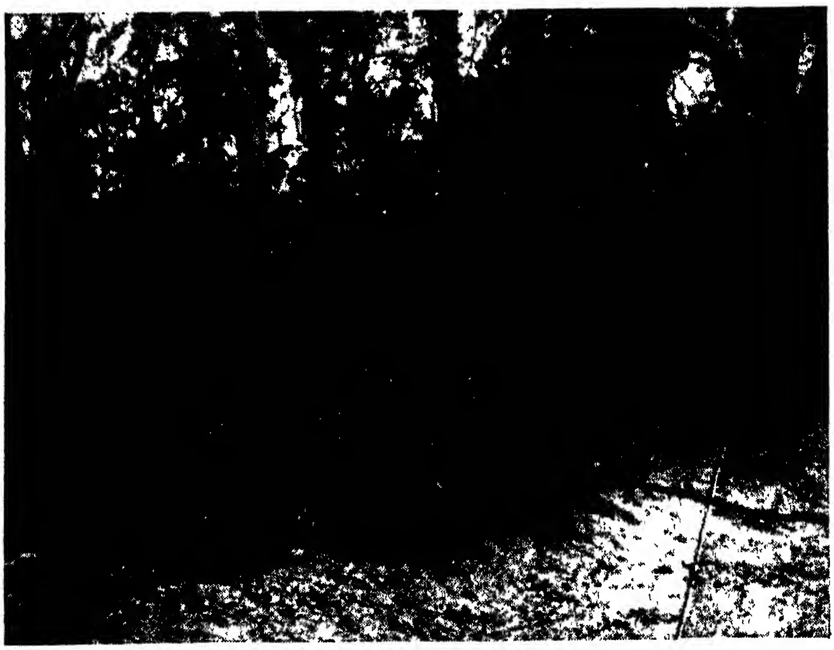


Fig. 3.
Typical jarrah forest on the Forest Grove gravelly sandy loam, Bockman Highway. There is a gravel pit in the foreground.

A further problem, connected with the very shallow nature of the A_1 horizon, was encountered when intensive development began. The surface layer, generally less than two inches thick, contained most of the organic matter and nitrogen and a large proportion of the available phosphate, potash and calcium. With deep ploughing this layer was buried and the subsoil subsurface exposed (A_2 horizon). The current method of development avoids ploughing the land until it has been in pasture for some years. The farmer ringbarks the trees, slashes the scrub and burns the area. The subterranean clover seed, together with a dressing of superphosphate is then scattered on the ash bed and a good establishment results.

The seasonal nature of production is a problem related to climate and soils. The dry summer and the comparatively low water holding capacity of most soils effectively prevent the establishment of perennial pasture plants. In consequence grazing stock must receive a supplementary ration in the late summer and autumn when production is at a very low level. This can be achieved by buying concentrates, by feeding cereal or clover hay conserved on the farm or by the development of summer pastures on summer-moist land. The total area of land with permanent water tables is adequate for the purpose of growing summer pastures on almost all farms but development in this direction has been slow. Problems of winter flooding and the selection and establishment of suitable species have not yet been solved.

There is a small timber industry which utilises the hardwood forests of the area. Speaking generally the quality of timber is not high; local edaphic conditions do not favour full development of the jarrah tree.

Fig. 4.
Typical winter swamp in virgin land near the Brockman Highway. This flat dries out for several months in the summer.

The State Forests Department is interested in the culture of softwoods in the Margaret River district; there are small plantations of *Pinus radiata* and *P. pinaster* at Margaret River and at Boranup. Some interesting nutritional problems have been described by O'Donnell and Lockhart (1945). *Pinus radiata* grows satisfactorily on brown soils developed in situ on the country rock (Keenan sandy loam). On lateritic soils pine growth is unsatisfactory but may be rectified by certain cultural treatments. Cultivation of the site both before planting and after establishment has a marked beneficial effect; zinc sulphate applied as a spray is beneficial in rehabilitating disordered pines. *Pinus pinaster,* having a lower fertility requirement, may be grown on soils on which *Pinus radiata* does not thrive.

SOIL PATTERNS.

In the Margaret River district, two distinct soil patterns can be seen. Firstly, the calcareous sandy soils of the coastal hills which are not used for agriculture and which will not be described further. Secondly, the slightly acid, gravelly, sandy or loamy soils of the jarrah forest which will be described in some detail. This soil pattern was examined in detail by spot surveys on farmland at Witchcliffe, Forest Grove (4,400 acres) and at Rosa Brook (3,250 acres). The Division of Soils, Council of Scientific and Industrial Research, which carried out these surveys also examined 120,000 acres of Crown land on the lower Blackwood River, north-east of Augusta, where the soils are similar to those of Margaret River. Further information on the soil pattern is provided by the soil survey of the Keenan Pine Plantation, Margaret River, described by O'Donnell and Lockhart (1945).

DESCRIPTION OF SOIL TYPES.

In the following descriptions it will be noted that related soil types are grouped into broader units called soil series. The soil types are characterised by the texture of the surface horizon and the types and series bear a proper name, generally of a locality. In describing the profile each horizon or sub-horizon is treated separately. In addition to the field description, the soil reaction, expressed according to the well known pH scale, is also shown. Other data, such as nitrogen content and clay content, is shown where available. All analyses are carried out on the fine earth fraction only, i.e., the material passing a two millimetre sieve. The fraction retained on the two millimetre sieve is referred to as gravel, the percentage of which is shown with the field description.

Only soil types of widespread extent and agricultural significance are shown. The most important agricultural soils belong to the Mungite and Forest Grove series. The Calgardup, Boodjidup and Willbay sands are less important types which are used for winter pastures. Gnarabup sand and the groups of alluvial and wet soils are classed as summer land which up to the present has been developed on a very small scale.

Mungite Series.—These soils are widely used for agriculture. They require surface drainage for best results. A fairly high water holding capacity enables pasture growth to continue into the early summer.

These profiles cover the greatest aggregate area in the district. They are found on level to gently sloping areas under a vegetation association of jarrah-marri-bull banksia (*Banksia grandis*). The parent material is a sandy clay of fluviatile origin. Drainage is somewhat restricted because of the heavy textured subsoil, and some temporary winter waterlogging occurs.

The series consists of three soil types—sand, sandy loam and loam. It may be noted here that following cultivation and the surface texture may be altered by admixture with deeper layers. Profiles in which ferruginous gravel occurs in the B_1 horizon are called the gravelly phase. Similarly, areas of Mungite sand or sandy loam which retain moisture into the summer months are grouped together as the wet phase. Typical profiles have the following features:—

MUNGITE SAND.

Horizon.	Depth.	Description.	Reaction (PH).	Clay.	Nitrogen.
	Inches.			%	%
A_1	0–1½	Dark grey sand (sometimes loamy sand) with moderate amounts of organic matter and root material. Sharply defined from A_2	5·8	6	0·07
A_2	1½–12	Light yellowish grey sand with some root material merging into	5·9	7	0·02
	12–25	Light yellowish grey clayey sand ...	6·0	7	...
B	25–45	Light grey and yellow mottled sandy clay, brittle when dry, plastic when wet	5·8	18	...
BC	45–72	Yellow and grey mottled clay with some grit and slight ferruginous gravel	5·7	27	...
		Mungite Sandy Loam			
A_1	0–3	Dark grey sandy loam with moderate amounts of organic matter and root material. Sharply defined from A_2	5·8	16	0·25
A_2	3–8	Grey to light grey sandy loam, merging into B_1	5·8	22	0·07
B_1	8–25	Light grey sandy clay loam, brittle when dry, slightly plastic when wet	5·8	28	0·02
B_2	25–60	Light grey with yellow and red inclusions sandy clay, brittle when dry, plastic when wet	5·7	35	0·01
		Mungite Loam—found only at the Nillup Settlement.			
A_1	0–1	Dark grey loam with moderate amounts of organic matter and root material. A weak crumb structure. Sharply defined from A_2	6·2	21	0·39
A_2	1–5	Yellowish grey loam merging into B_1	5·8	22	0·22
B_1	5–15	Light grey, with slight yellow mottling clay, hard when dry, plastic and stiff when wet	5·5	38	...
	15–45	Light grey, with yellow and red mottling clay	5·3	41	...
BC	45–108	Light grey, with red and yellow mottling, clay with slight ferruginous gravel	5·2	50	...

Forest Grove Series.—These soils are arable except where laterite boulders occur. They are widely used for agriculture. Surface drainage is good but water-holding capacity is rather low.

These profiles have a widespread distribution in the district. They are found on gently sloping areas under a vegetation association of jarrah-marribull banksia which is sometimes replaced by jarrah-sheoak association. The parent material is a sandy clay with a well-developed surface laterite horizon. Drainage is freer than in the Mungite series but some temporary winter waterlogging occurs.

The series consists of three soil types:—Gravelly sand, gravelly sandy loam and gravelly loam. Where lateritic boulders occur as a surface formation a boulder phase is recognised. Typical profiles have these features:—

FOREST GROVE GRAVELLY SAND.

Horizon.	Depth.	Description.	Reaction (PH).	Clay.	Nitrogen.
	Inches.			%	%
A_1	0–1½	Grey gravelly sand with moderate amounts of organic matter. Some lateritic gravel scattered on surface. Merges into A_2. Gravel 86% ...	6·2	6	0·31
A_2	1½–14	Yellowish grey very gravelly sand. Gravel 81%	6·4	4	0·04
B_1	14–24	Yellowish grey very gravelly clayey sand with boulders. Gravel 87% ...	6·4	8	...
B_2	24–39	Yellowish grey very gravelly clay, with boulders. Gravel 11%	6·5	57	...
BC	39–84	Mottled light grey, yellow and red gravelly clay; fragmentary when dry, plastic when wet. Gravel 29%	5·9	58	...

Forest Grove Gravelly Sandy Loam.

A_1	0–1½	Dark grey, very gravelly sandy loam with moderate amounts of organic matter. Some lateritic gravel scattered on surface. Gravel 77% ...	7·4	10	0·25
A_2	1½–12	Greyish yellow, very gravelly sandy loam. Gravel 73%	6·6	13	0·06
B_1	12–18	Greyish yellow very gravelly sandy clay loam with boulders. Gravel 72% ...	6·3	22	...
B_2	18–48	Greyish yellow very gravelly clay with frequent boulders. Gravel 75% ...	6·4	43	...

Forest Grove Gravelly Loam—rarely seen.

A_1	0–1	Grey gravelly loam with moderate amounts of organic matter	...	...	...
A_2	1–8	Yellowish grey gravelly loam.	...	...	...
B_1	8–18	Yellowish grey and yellowish brown gravelly sandy clay loam with boulders	...	...	...
B_2	18–48	Dull yellow and yellow brown mottled very gravelly clay with frequent boulders	...	...	...

Calgardup Sand.—This soil has low water holding capacity and free drainage. It is useful only for winter pastures.

The Calgardup is a podsolised sand of fluviatile origin occurring as valley deposits and as broader outwash areas near the Blackwood River frontage. The drainage is very free and there is a characteristic vegetation association of jarrah-marri-bull banksia. The normal colour of the profile is yellow. A brown phase has also been mapped in the surveyed area. A typical profile is described as follows:—

Horizon.	Depth.	Description.	Re-action. (PH).	Clay.	Nitrogen.
	Inches.			%	%
A_1	0–1	Dark yellowish grey sand with moderate amounts of organic matter	5·6	2	0·08
A_1	1–27	Yellow sand, loose when dry, slightly coherent when wet	6·5	4	...
B	27–72	Yellow sand with slight grit and very slight ironstone gravel	6·6	5	...
	72–110	Yellow sand, slightly coherent (slight increase in clay fraction) with slight grit and slight ironstone gravel			
BC	110–120	Yellow brown clayey sand with ironstone gravel			

Fig. 5.

Poor wet flats of the Scott River Plains which, under present conditions, have no agricultural value. The massive ironstone hardpan lies a few inches below the sandy surface and is seen exposed in the car tracks.

Willbay Sand.—This soil is droughty and very infertile. It is not used agriculturally.

The Willbay sand was first recognised and mapped at Denmark (Hosking and Burvill, 1938). It is essentially a highly leached, quartzose sand, which occurs extensively in the south coastal areas. The parent material is a fluviatile sand forming valley deposits and as broader outwash areas. Drainage is very free. There is a characteristic vegetation association of *Banksia ilicifolia and B. attentuata* forming an open woodland with a scrubby undergrowth. The fertility status appears to be extremely low. A typical profile is as follows:—

Horizon.	Depth.	Description.	Reaction (PH).	Clay.	Nitrogen.
	Inches.			%	%
A_1	0–8	Grey to dark grey sand with considerable raw humus (brownish coloured) and root material ...	6·7	2	...
A_2	8–20	Light grey sand, incoherent whether wet or dry	4·8	...	...
	20–84	White sand as A_2	4·9	...	...

Gnarabup Sand.—This soil is excessively wet in winter but is used for summer crops with liberal fertilizer.

This soil is a typical humus podsol. The A_1 is a zone of raw humus accumulation, the A_2 is highly bleached, and a black humus pan occurs in the B_2. It is typical of the wet heath soils which occur extensively in the south coastal areas. The land surface is flat and the soil type may occur on the highest part of the watershed as well as on outwash areas, where drainage is restricted and appropriate parent materials occur. The soil is waterlogged in winter, and a water table may persist throughout the summer. There is a characteristic heath vegetation with which is associated the Christmas tree (*Nuytsia floribunda*). The parent material is a highly quartzose sand of fluviatile origin overlying a clay layer. A typical profile has these features:—

Horizon.	Depth.	Description.	Reaction (PH).	Clay.	Nitrogen.
	Inches.			%	%
A_1	0–5	Very dark grey to black, speckled sand with considerable raw humus	4·6	Less than 2	0·41
A_2	5–12	Grey sand, loose and incoherent ...	4·7	Less than 2	0·11
	12–24	Light grey sand, loose and incoherent	5·0	Less than 2	...
B_1	24–39	Light brownish grey sand	5·2	Less than 2	...
	39–46	Very dark brown and black organic and ferruginous hardpan. Very hard.	4·7	2	0·05
	46–60	Dark brown organic hardpan. Very hard	...	...	...
B_2	60–69	Yellow and brown mottled clay with slight organic stain	4·6	26	0·07
	69–75	With medium ferruginous gravel ...	...	...	...
BC	75–81	Light grey and red mottled clay ...	...	...	...

Boodjidup Sand.—This soil has low water holding capacity and fair winter drainage. It is used to a limited extent for winter pastures.

The Boodjidup sand is of similar origin to the Gnarabup. It differs from the latter in its freer drainage and its less well developed accumulation of raw humus in the A_1 horizon. It is found on gentle slopes of watersheds under a stunted vegetation association of jarrah-marri-bull banksia. The parent material, as in the Gnarabup is a quartzose fluviatile sand. This soil type is of rather restricted occurrence, and its profile has these characters:—

Horizon.	Depth.	Description.	Re-action (PH).	Clay.	Nitro-gen.
	Inches.			%	%
A_1	0–1	Speckled grey and dark grey sand with moderate amounts of organic matter and root material. Sharply divided from A_2	6·0	Less than 2	0·15
A_2	1–7	Speckled grey and light grey sand with root material; loose when dry, incoherent when wet, merging into	5·9	Less than 2	0·04
	7–24	Very light grey sand, loose when dry, incoherent when wet	5·9	Less than 2	0·01
B_1	24–36	Brown organic stained sand	5·8	7	0·01
	36–69	Dark brown to black organic hardpan with some grit and gravel ...	5·5	8	0·05
BC	69–84	Light bluish grey with green mottlings heavy clay	4·8	66	0·02

Wet Soils.—These soils have not been developed agriculturally. They are too wet in winter but some may have a use for summer crops.

This is a miscellaneous group of soils found in shallow depressions and blocked drainage lines. They are all subject to winter flooding but the summer water regime varies rather widely. The soils range from meadow podsols to bog soils and have been grouped broadly as S_1, S_2, S_3, and S_4 on the basis of profile features. S_2 and S_4 are the most widely distributed types. The vegetation associations vary rather widely. Paperbarks (*Melaleuca spp.*), *Banksia littoralis* and teatree (*Agonis sp.*) are prominent species, with rushes dominant in the very wet localities. Profiles representative of each grouping are described as follows:—

S_1.

Peat swamps with permanent shallow water tables.

Horizon.	Depth.	Description.	Re-action (PH).	Clay.	Nitro-gen.
	Inches.			%	%
	0–33	Black humified peat, very wet ...	...	..	...
	33–45	Very dark grey to black, peaty sand clay, very wet	...	. .	...

S_2.

Wet soils formed on sands of fluviatile origin. Meadow podsols.

Horizon.	Depth.	Description.	Re-action (PH).	Clay.	Nitro-gen.
	Inches.			%	%
	0–24	Dark grey sand with moderate amounts of organic matter	...	...	...
	24–42	Dark grey sand with organic stain, very wet	...	...	...
	42–72	Light grey sand with faint organic stain, very wet	...	...	...

S_3.

Wet soils formed on sands and clays of fluviatile origin. Meadow podsols.

A_1	0–5	Grey loamy sand with moderate amounts of organic matter, fairly well defined from A_2	5·5	7	0·06
A_2	5–17	Light yellow grey, slightly mottled, clayey sand, hard and brittle when dry, slightly plastic when wet ...	5·4	14	...
B_1	17–30	Yellowish grey sandy clay loam, friable when dry, plastic when wet ...	5·2	21	...
B_2	30–72	Yellow grey, with yellow and red-brown mottling, sandy clay	5·2	28	...

S_4.

Shallow basins with massive laterite horizons.

A_1	0–6	Very dark grey loamy sand with moderate amounts of organic matter	...	...	...
A_2	6–24	Light yellowish grey gritty sand ...	...	...	...
B	24–+	Massive ironstone hardpan	...	...	...

Alluvial Soils.—These soils are excessively wet in winter but are useful for summer grazing. There is some development with paspalum and kikuyu grass. They have good possibilities.

Alluvial soils are fairly extensive formations in parts of the area. They occur as long narrow bands associated with creeks. The parent material consists of recent waterlaid deposits together with some colluvial material from the valley sides. The vegetation association varies, and is generally more luxuriant than on other soils of the area. Soil profiles range from grey podsolised sands to brown loams. Two typical profiles are described below:—

Profile 1.

A_1	0–4	Greyish brown loam with small amounts of fine gravel	5·2	19	0·13
B	4–15	Brown light clay. plastic when wet ...	6·5	45	0·05
	15–24	Bright brown clay	5·8	61	...
BC	24–48	Yellowish grey and red mottled clay ...	5·7	59	...
	48–72	Light yellowish grey, yellowish grey and red mottled, clay	5·5	57	...

Profile 2.

Horizon.	Depth.	Description.	Re-action (PH).	Clay.	Nitro-gen.
	Inches.			%	%
A_1	0–5	Drab yellowish grey gravelly loam with crumb structure merging into B_1 ...	5·5	33	0·08
B_1	5–13	Yellowish grey with yellow inclusions, clay, powdery when dry, plastic when wet. Merges into next horizon ...	5·6	38	0·08
	13–32	Yellowish grey, with yellow, red and grey inclusions, sandy clay with slight gravel	5·4	42	0·03
BC	32–50	Yellowish grey with yellow and some red-brown inclusions, sandy heavy clay with moderate gravel	...	...	...

ACKNOWLEDGMENTS.

The soil surveys in the Margaret River district were carried out in 1944-45 by the Division of Soils, Council for Scientific and Industrial Research working in collaboration with the Department of Lands and Surveys and the Department of Agriculture of W.A. The author wishes to express appreciation of the assistance rendered by State officers and to mention in particular Mr. J. H. Urbahns of the Lands Department and Dr. L. J. H. Teakle of the Department of Agriculture.

BIBLIOGRAPHY.

Bennetts, H.W. (1941), *Journ. Agric. West. Aust.*, 18: 133-136.
Bennetts, H. W., and Hall, H. T. B. (1939), *Journ. Agric. West. Aust.* 16: 156-160.
Carroll, Dorothy (1944), *Journ. Agric. West. Aust.*, 21: 313-319.
Jones, L. T. (1948), private communication.
Jones, L. T., and Elliott, H. G. (1944), *Journ. Agric. West. Aust.* 21: 4.
O'Donnell, J., and Lockhart, W. (1945) Australian Forestry 9:2, 1945.
Roberts, R. P. (1944), *Journ. Agric. West. Aust.* 21: 3.
Rowley, Sheila (1946), *Journ. Aust. Inst. Agric. Sci.* 12: 130-133.

ERRATA.

Journal of Agriculture, Volume XXV. (Second Series), No. 3, September, 1948.

Contents Page, eighth item, for "The Control of Root-Knot with D.D.T." substitute "The Control of Root-Knot with D.D."

Page 224, Fig. 9 caption, second line for "(Gand H)" substitute "(G and H)".

Page 227, paragraph 6, last line for "A louvred winder" substitute "A louvred window."

Page 265, paragraph 2, second line, for "Classing of such clips to the best" substitute "Classing of such clips only calls for".

Page 274, caption under illustration, for "Tender wool fibres have broken" substitute "Tender wool. Fibres have broken."

Page 279, paragraph one, line one, for "black or grey fibre" substitute "black or grey fibres."

OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE RECORDING SCHEME.

M. CULLITY, Superintendent of Dairying; B. H. DRAKES, Assistant, Dairy Records.

IN previous years in reporting upon the operation of the Official Australian Pure bred Dairy Cattle Recording Scheme attention was drawn to the relative small number of herds which were submitted for testing and reference was also made to the fact that there were a number of breeders of pure bred cattle who were able to obtain high prices for the progeny of their herds solely because of the good work carried out by those who were consistently submitting their herds for testing.

During the year 1947-48, the number of herds submitted showed an increase while the number of cows was higher than in any previous year. However, the average results were not as good as could be expected. The yield of 297lb. of butter-fat is lower than for many years. Although this is undoubtedly due to the entry to test for the first time of a number of new herds, it is believed that breeders generally could, with very little effort, obtain better results.

This comment can also be applied to the number of cows which have achieved "standard" production. These represent 54 per cent. only of those entered for test. In other words, 46 per cent. did not reach standard. In view of the favourable season this figure is disappointing.

It is realised that the low percentage achieving standard production would not apply to every herd as there are a number where the great proportion of the cows are high producers. It follows, therefore, that there are other herds in which almost all cows are producing below the standard required. This is a serious matter, particularly from the point of view of the commercial dairy farmer, who looks to the pure bred herds as a source of bulls capable of lifting production. That this is so is due to the consistently good result achieved over a number of years by a few pure bred herd owners who have been responsible for building up the industry with a large number of satisfactory bulls.

Unfortunately the good work of these few men is being used by others who have not shown similar results, in order to obtain good prices for their surplus bulls.

A survey of the causes of low yields indicates that in many cases they are due to a low inherent-capacity for production posssesed by many of the cows. It appears that culling from pure bred herds is rarely carried out with a view to lifting the general average quality of the pureherds at large. Where culling does occur, the surplus animals often find their way into other herds, usually of men who aim to become stud breeders.

It also is apparent that in many pure bred herds, particularly those commenced in recent years, the bulls in use are incapable of producing progeny of better quality than the cows with which they are mated. It is becoming increasingly urgent that only "proved-for-production" bulls should be used in stud herds.

There is also no doubt that poor management both in respect to feeding and general husbandry has contributed to low yields.

In an endeavour to encourage breeders to look upon herd-testing as a means of improving their herds, rather than a method of advertising a few individual high yields, the administration of the rules governing the scheme has been made more stringent to ensure that only those cows which can be exempt under the rules are not tested.

It is hoped that breeders will endeavour to use the data provided as a means of lifting the average quality of their herds rather than as a means of obtaining one or two high performances from individual cows, with a view to using such records as a means of advertising their herds.

The number of cows completing test during the year was 676 from 46-herds, compared with 517 cows from 35-herds the previous year. This is an increase of 30.7% on the number of cows.

Of the above number, 69 cows were withdrawn for various reasons before completing 150 days, and these are not included in any of the averages.

The remaining 607 cows averaged 6,386lbs. milk. Average test 4.65%, and 297.24lbs. butterfat, or 1.29lbs. of butterfat less than the previous year.

The average production of all cows completing test since 1934 is shown in Table 1.

TABLE 1.

AVERAGE PRODUCTION—PURE BRED HERDS.

Year.	No. of Cows Completing Test.	Average Butterfat per Cow.
		lb.
1934–35	305	320.26
1935–36	367	297.17
1936–37	319	300.87
1937–38	333	298.08
1938–39	375	292.40
1939–40	382	305.88
1940–41	372	298.38
1941–42	290	322.84
1942–43	294	321.27
1943–44	289	311.57
1944–45	344	289.42
1945–46	393	279.93
1946–47	460	298.53
1947–48	607	297.24

The percentage of cows passing standard since 1937-38 is shown in Table 2. Compared with the previous year, the percentage of all breeds passing a standard shows a slight increase, viz.:—1.9%, Jerseys showed an increase of 9.6%, Guernseys an increase of 11.8%, and A.I.S. a decrease of 11.7%.

It will be seen that the percentage of all breeds passing standard is still only 54%.

TABLE 2.

PERCENTAGE OF COWS PASSING STANDARD.

Year.	Australian Illawarra Shorthorn.	Guernsey.	Jersey.	Total.
	%	%	%	%
1937-38	59.1	58.7	35.6	53.1
1938-39	53.8	71.4	55.2	57.9
1939-40	48.0	77.5	64.2	59.2
1940-41	52 0	61.0	51.0	54.0
1941-42	73.0	68.3	59.7	68.3
1942-43	67.6	67.9	55 0	64.3
1943-44	57.8	52.1	73.3	61.9
1944-45	52.5	43.4	72.2	57.3
1945-46	43 1	33.3	52 9	43.8
1946-47	56.1	42 6	53.6	52.1
1947-48	44.4	54.4	63.2	54.0

The number of cows passing standard, and the proportion in each age group of each breed is set out in Table 3. The percentage of mature cows passing standard (40.9%) is lower than in any of the other age groups.

It is interesting to note that the percentage of cows passing standard in the age groups from Jr.4 (43.4%) shows a progressive increase down to the Jr. 2-year-olds, which show the highest percentage of any age group, viz.:—68.0%.

TABLE 3.

COWS PASSING STANDARD.

Age Class.	A.I.S.		Guernsey.		Jersey.		All Breeds.	
	No of Cows Tested.	No. Passing Standard.	No. of Cows Tested.	No. Passing Standard.	No. of Cows Tested.	No. Passing Standard.	No. of Cows Tested.	No. Passing Standard.
Mature	57	14	37	16	72	38	166	68
Senior 4 years	8	1	5	5	17	11	30	17
Junior 4 years	17	4	9	5	20	11	46	20
Senior 3 years	34	15	11	6	24	15	69	36
Junior 3 years	24	10	11	8	28	16	63	34
Senior 2 years	25	15	15	9	27	16	67	40
Junior 2 years	80	50	24	12	62	51	166	113
Total	245	109	112	61	250	158	607	328
Percentage	44 4		54 4		63 2		54.0	

The average production of milk and butterfat in each age group of each breed is shown in Table 4. The only age groups (all breeds) which failed to reach standard were the mature and senior three-year-olds. The junior two-year-olds gave the best relative performance. The mature cows (all breeds) were approximately 20lbs. butterfat higher than last year.

In the A.I.S. breed the only two age groups to exceed standard were the senior two and junior two-year-olds, while all age groups in the Guernseys, except

matures, exceeded standard. The Jersey breed put up a noteworthy performance, all age groups being well over standard. A further study of this table shows that in comparison with last year, the A.I.S. breed averaged 32.17lbs. less, the Guernseys 20.96 more, and Jerseys 11.86 more. The 250 Jerseys (all age groups) averaged 6,088lbs. milk, and 325.70lbs. butterfat, which is very creditable.

TABLE 4.

AVERAGE PRODUCTION IN EACH AGE CLASS—1947-48.

AGE CLASS.	Butter Fat Standard Required lb.	A.I.S.				Guernsey.			
		No. of cows.	Average Milk lb.	% Test.	Average Butter Fat lb	No. of Cows	Average Milk lb.	% Test	Average Butter Fat lb
Mature	350	57	7,470	3 88	290 41	37	6,448	5 14	331 52
Senior 4 years	330	8	7,184	3·82	274 90	5	7,606	5 34	406·90
Junior 4 years	310	17	7,152	3·83	274 16	9	6,702	4·93	330·72
Senior 3 years	290	34	7,076	3 38	239·44	11	6,155	5 10	314 37
Junior 3 years	270	24	6,830	3 89	267·12	11	6,227	4 93	307·41
Senior 2 years	250	25	7,001	3·87	271·09	15	5,858	5 24	307·11
Junior 2 years	230	80	6,108	3 97	243 10	24	4,992	5 07	253·36
TOTALS		245	6,831	3·83	262 00	112	6,079	5 11	310·76

AGE CLASS.	Butter Fat Standard Required lb.	Jersey.				All Breeds.			
		No of cows	Average Milk lb.	% Test.	Average Butter Fat lb	No. of Cows.	Average Milk lb	% Test	Average Butter Fat lb
Mature	350	72	7,044	5 22	360 90	166	6,058	4 80	333·40
Senior 4 years	330	17	6,451	5 36	346 12	30	6,839	4 93	337 26
Junior 4 years	310	20	6,194	5 56	344 69	46	6,647	4 75	315·89
Senior 3 years	290	24	6,298	5 37	338·59	69	6,659	4 29	285 87
Junior 3 years	270	28	5,432	5 41	294·30	63	6,113	4 68	286 24
Senior 2 years	250	27	5,333	5·16	275 29	67	6 103	4 62	280·85
Junior 2 years	230	62	5,391	5·48	295 55	166	5,679	4 65	264·18
TOTALS		250	6,088	5 34	325 70	607	6,386	4 65	297 24

A comparison between the production of all cows under test 150 days and over, with cows completing 273 days—according to breed and age class is set out in Table 5. A study of the 273 day averages discloses that all the age groups in each breed, with the exception of the mature and senior four-year-old A.I.S., exceeded the standard of butterfat for their respective age groups. This is a decided improvement on the previous year, when it will be recalled that in the mature cow classes the only breed to exceed standard was the A.I.S.

It will also be noted that the 273-day average for all breeds is higher this year in all age groups except the senior four and senior three-year-olds.

Of the 607 cows included in the averages, 72.6% completed 273 days, compared with 80% last year, and 72% in 1945-46.

TABLE 5.

COMPARATIVE TABLE SHOWING AVERAGE PRODUCTION IN EACH AGE CLASS OF COWS UNDER TEST 150 DAYS OR OVER AND COWS COMPLETING 273 DAYS.

Age Class.	Standard Butter Fat Required.	A.I.S.				Jersey.			
		No. of Cows Tested 150 days or over.	Average Butter Fat lb.	No. of Cows Completing 273 days.	Average Butter Fat lb.	No. of Cows Tested 150 days or over.	Average Butter Fat lb.	No. of Cows Completing 273 days.	Average Butter Fat lb.
Mature	350	57	290 ·41	29	336 ·98	72	360 ·90	59	394 ·26
Senior 4 years	330	8	274 ·90	6	271 ·80	17	346 ·12	13	391 ·51
Junior 4 years	310	17	274 ·16	7	350 ·36	20	344 ·69	15	354 ·04
Senior 3 years .	290	34	239 ·44	23	313 ·46	24	338 ·59	22	343 ·63
Junior 3 years	270	24	267 ·12	11	315 ·85	28	294 ·30	15	320 ·59
Senior 2 years	250	25	271 ·09	21	281 ·01	27	275 ·29	17	311 ·31
Junior 2 years .	230	80	243 ·10	64	261 ·61	62	295 ·55	55	311 ·85

Age Class.	Standard Butter Fat Required.	Guernsey.				All Breeds.			
		No. of Cows Tested 150 days or over.	Average Butter Fat lb.	No. of Cows Completing 273 days.	Average Butter Fat lb.	No. of Cows Tested 150 days or over.	Average Butter Fat lb.	No. of Cows Completing 273 days.	Average Butter Fat lb.
Mature	350	37	331 ·52	25	381 ·00	166	333 ·40	113	376 ·63
Senior 4 years .	330	5	406 ·98	5	406 ·90	30	337 ·26	24	364 ·79
Junior 4 years ..	310	9	330 ·72	8	347 ·73	46	315 ·89	30	351 ·50
Senior 3 years ..	290	11	314 ·37	9	334 ·81	69	285 ·87	54	329 ·12
Junior 3 years .	270	11	307 ·41	10	323 ·79	63	286 ·24	36	320 ·03
Senior 2 years ..	250	15	307 ·11	11	351 ·31	67	280 85	49	307 ·31
Junior 2 years	230	24	253 ·36	16	296 ·24	166	264 ·18	135	286 ·18

Leading Sires:

The leading sire for the year was again the Jersey bull, "Mornmoot Northwood Beau," owned by R. H. Rose & Son. His best six daughters averaged, with allowances, 567.81lbs. butterfat. He was followed by the Guernsey bull, "Koojan Ace's Warspite" (Denmark Research Station), 500.36lbs. butterfat, and "Congelin Mandarin" (Jersey), owned by D. Bradford, 404.17lbs. butterfat. Averages of the six best, and all daughters are shown in Table 6.

The performances of 21 sires for the years 1943-44 to 1947-48 are given in Table 7. In each case the productions are shown with and without allowances. Where daughters have had more than one lactation the yield included is the average of all of such daughters' lactations.

TABLE 6.

LEADING THREE SIRES, 1947–48.

Name of Bull.	Owner.	Sire.	Dam.	Average Production of six best daughters.		Average Production of all daughters under test.		
				Without allowances (lbs. butter fat).	With allowances (lbs. butter fat).	No. of Daughters under Test.	Without allowances (lbs. butter fat).	With allowances (lbs. butter fat).
Mornmoot Northwood Beau (Jersey) (17798)	R. H. Rose & Son	Glen Iris Golden Beau (14629)	Mornmoot Northwood Madeira 7th (63202)	505.67	567.81	24	360.08	410.82
Koojan Ace's Warspite (Guernsey) (5943)	Denmark Research Station	Homestead Ace (Imp.) U.S.A. (1631)	Koojan Ideal's Jewel (7257)	395.11	500.36	7	379.25	482.04
Congelin Mandarin (Jersey) (14542)	D. Bradford	Clarendon Eyre Oxford Gamboge (10274)	Clarendon Eyre Tangerine 6th (43396)	330.33	404.17	9	292.24	357.81

TABLE 7.

AVERAGE PRODUCTION OF DAUGHTERS OF 21 SIRES, YEARS 1943–44 TO 1947–48.

Name of Bull.	Breed.	Sire.	Dam.	Average Production of all Daughters.			
				No. of Daughters under Test.	Total Number of Lactations. *	Without Allowances (lbs. butter fat).	With Allowances (lbs. butter fat).
Austral Park Wonderful Standard (12423)	Jersey	Ellerdale Wonderful Masterman (11561)	Ellerdales Wonder Golden (47992)	17	22	449.70	485.79
Mornmoot Northwood Beau (17798)	Jersey	Glen Iris Golden Beau (14629)	Mornmoot Northwood Madeira 7th (63202)	33	59	384.34	460.97
Grassvale Gold Boy (14684)	Jersey	Belgonia Gold Boy (12458)	Grassvale Lady Fowler 17th (48536)	14	26	415.16	452.82
Mornmoot Laver (17792)	Jersey	Werribee Laverock (9085)	Mornmoot Princess Madeira 9th (58569)	10	10	324.66	420.56
Homestead Ace (Imp.) U.S.A. (1631)	Guernsey	Archer of Cloture (Imp.) (133,486)	Laddie's Blossom (118,788)	12	21	346.07	409.35
Koojan Ideal's Dictator (4167)	Guernsey	Glenburnie Ideal (Imp.) U.S.A. (2548)	Koojan Golden Butterfly (4339)	12	12	339.19	401.88
Greenmount Golden Sultan (14688)	Jersey	Bellefaire Bonaparte's Bonetienne (9224)	Charming Lass of Greenmount (20903)	10	21	361.38	397.70
Koojan Beau Ideal (4965)	Guernsey	Glenburnie Ideal (Imp.) U.S.A. (2548)	Koojan Ace's Mignonette (3898)	12	21	341.13	397.07
Wooroloo Red Baron (6412)	A.I.S.	Parkview Guardian (2557)	Wooroloo Bloomer (5218)	17	26	315.30	392.46
Summerlea Churchill (6236)	A.I.S.	Summerlea Togo (1527)	Summerlea Empress (14247)	17	18	302.47	382.32
Selsey Wyandottes Prince (18058)	Jersey	Samares Golden Prince (Imp.) (13439)	Selsey Wyandotte (41949)	18	18	328.78	355.14

TABLE 7—*continued.*

AVERAGE PRODUCTION OF DAUGHTERS OF 21 SIRES, YEARS 1943–44 TO 1947–48—*continued.*

Name of Bull.	Breed.	Sire.	Dam.	Average Production of all Daughters. No. of Daughters under Test.	Total Number of Lactations. *	Without Allowances (lbs. butter fat).	With Allowances (lbs. butter fat).
Westby Monarch (5404)	A.I.S.	Westby Starlight (3604)	Westby Carnation 2nd (18515)	13	13	275.08	348.98
Tipperary Ace (6336)	A.I.S.	Blackland's Monarch's Commander (1877)	Yallah Farm Maggie 2nd (1272)	21	34	281.46	342.19
Blackland's Jean's Supreme (1871)	A.I.S.	Fussy's Monarch of Hill-view (493)	Jean 7th of Blacklands (7425)	12	12	284.80	330.15
Navua Coronation Star (14929)	Jersey	Dreamer's Hamptonne Star (Imp.) (12384)	Navua Coronation Cecilia (41235)	10	10	293.98	311.59
Rosecliffe Marchalong (15094)	Jersey	Rosecliffe Flowers' Bravo (12121)	Rosecliffe Viola (35771)	10	20	271.20	309.73
Westby Masterpiece (5403)	A.I.S.	Westby Searchlight (3604)	Westby Pearl (15140)	18	18	248.77	303.30
Newstead Royal Sun (7252)	A.I.S.	Newstead Royal Chief (6040)	Newstead Emerald 46th (26901)	12	12	241.28	283.75
Glanavon Genius (3957)	A.I.S.	Villiers of Darbalara (2386)	Gold 11th of Raleigh (17507)	12	13	226.38	249.12
Cranbourne Charlie (3993)	Guernsey	Broofield's Prince Henry (3257)	Koojan Ace's Doreen	13	13	197.23	246.81
Tipperary Amy's Mascot (6338)	A.I.S.	Newstead Royal Light (3416)	Tipperary Amy (18313)	11	11	190.06	227.31

* In compiling this table where daughters have had more than one lactation, the yield included, is the average of all of such daughter's lactations.

The productions of the three leading cows in each age class are given in Table 8. It will be seen that two were over 700lbs. butterfat, one over 600lbs. butterfat, eight over 500lbs. butterfat, and ten over 400lbs. butterfat. Fourteen of the twenty-one cows are Jerseys, five Guernseys, and two A.I.S.

TABLE 8.

PURE BRED HERD TESTING.

THREE LEADING COWS IN EACH AGE CLASS, 1947-48.

Name of Cow.	Breed.	Milk.	Average Test.	Butter Fat.	Owner.
MATURE (STANDARD 350 LBS. BUTTERFAT)					
Camden Ariadne	Jersey	10869	6·94	754·37	C. E. Kruger
Congelin Iolanthe 8th	Jersey	13215	5·57	737·19	D. Bradford
Mokine Beauty	Jersey	11625	5·54	644·50	T. H. Wilding
SENIOR 4 YEAR OLD (STANDARD 330 LBS. BUTTERFAT)					
Grass Vale Silvermine 2nd	Jersey	9990	5·31	530·70	R. H. Rose & Son.
Walgett Handsome Girl 29th	Jersey	7263	6·91	502·05	C. J. Cunningham
Travalgan Lady Eion 16th	Jersey	8280	5·74	475·53	W. H. & T. F. Robinson
JUNIOR 4 YEAR OLD (STANDARD 310 LBS. BUTTERFAT)					
Grass Vale Golden Cream 26th	Jersey	8677	6·18	536·92	R. H. Rose & Son
Travalgan Starbright 23rd	Jersey	8310	6·21	515·76	J. C. Bushell
Muresk Anna	Guernsey	10663	4·60	491·12	Muresk Agricultural College
SENIOR 3 YEAR OLD (STANDARD 290 LBS. BUTTERFAT)					
Grass Vale Eve	Jersey	9217	5·79	533·95	R. H. Rose & Son
Carydale Precious	Jersey	9492	5·51	523·37	G. Layman
Capel Gibson Girl 2nd	A.I.S.	12396	4·01	498·23	B. W. Prowse
JUNIOR 3 YEAR OLD (STANDARD 270 LBS. BUTTERFAT)					
Juadine Peerless Lily 23rd	Jersey	9329	5·90	551·27	M. B. Stott
Denmark Bonnie Marie	Guernsey	8022	5·56	446·74	Denmark Research Station
Greyleigh Precious Gem 3rd	A.I.S.	10902	3·89	424·19	W. G. Burges
SENIOR 2 YEAR OLD (STANDARD 250 LBS. BUTTERFAT)					
Grass Vale Buttercup 17th	Jersey	9394	5·22	490·86	R. H. Rose & Son
Denmark Ace's Velvet	Guernsey	7545	5·97	450·16	Denmark Research Station
Muresk Helianthus	Guernsey	8598	5·22	449·60	Muresk Agricultural College
JUNIOR 2 YEAR OLD (STANDARD 230 LBS. BUTTERFAT)					
Carydale Royal Princess	Jersey	8611	6·07	522·98	G. Layman
Denmark Golden Veronica	Guernsey	7299	6·03	440·72	Denmark Research Station
Travalgan Lady Eion 27th	Jersey	7389	5·77	426·56	W. H. & T. F. Robinson

New Records.

Five new records were established during the year:—

Jersey (Mature Class, 273-days), and 365-day Record—All Breeds.

"Camden Ariadne," owned by C. E. Kruger, produced 10,869lbs. milk; average test, 6.94%, and 754.37lbs. butter fat in 273 days. This is 72.64lbs. butterfat better than the previous record put up by "Juadine Peerless Lily 13th" in 1946. "Camden Ariadne," who is by "Greenmount Golden Sultan" from "Greenmount Sweet Wonder," also holds the junior four-year-old (Jersey) record with 8,764lbs. milk, average test 6.84%, and 600.32lbs. butterfat.

After completing her 273 day record referred to above, "Camden Ariadne" continued under test to 365 days, her production then being 12,975lbs. milk, aver-

age test 7.0%, and 908.85lbs. butterfat, which establishes a new 365 day record for the State. The previous 365 day record was held since 1928 by the Guernsey cow "Picton Trequeen Flirt," owned by A. W. Padbury, her production being 16,675lbs. milk with an average test of 5.21%, equal to 870.06lbs. butterfat.

Jersey Junior Two-year-old Class. West Australian-bred, Junior Two-year-old Class. All Breeds Junior Two-year-old.

"Carydale Royal Princess," owned by G. Layman, of Donnybrook, gained the record for all three of the above classes, her production being 8,611lbs. milk. Average test, 6.07, and 522.98lbs. butterfat. The record for the two latter classes was previously held by "Koojan Ideal's Daphne" (Guernsey), owned by A. W. Padbury, with 8,821lbs. milk, average test 5.54%, and 489.13lbs. butterfat, and the record for the Jersey Junior Two-year-old Class was held by "Grass Vale Northwood Eve" (R. H. Rose & Son)—7,755lbs. milk, average test 5.81%, and 451.23lbs. butterfat.

The new record holder, "Carydale Royal Princess," is by "Juadine Royal," whose dam, "Juadine Queen," held the Jersey junior two-year-old record in 1943 with 421.64lbs. of butterfat. Her dam is "Colmyn Janis 2nd," who produced 292.30lbs. of butterfat in 273 days as a senior two-year-old.

The productions of all cows completing test during the year are shown in Table 9.

TABLE 9—HERD TESTING.

Cows which completed test during the twelve months ended 30th June, 1948.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS UNDER 2½ YEARS—STANDARD 230 LBS. BUTTER-FAT.											
Carydale Royal Princess	Jersey		26-6-45	4-4-47	273	20·5	8,611	6·07	522·98	G. Layman	Juadine Royal (20841)
Denmark Golden Veronica	Guernsey	12686	17-8-45	4-10-47	273	23	7,299	6·03	440·72	Denmark Research Station	Denmark Ace (5738)
Travalgan Lady Eion 27th	Jersey		29-4-45	29-6-47	273	23	7,389	5·77	426·56	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Muresk Dora	Guernsey	13928	26-8-44	9-2-47	273	33	9,429	4·43	418·31	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Grassvale Lady Fowler 46th	Jersey		15-5-45	25-8-47	273	21·5	6,909	5·89	407·16	R. H. Rose & Son	Glen Iris Golden Oxford (12694)
Warralyn Marie 12th	Jersey		27-5-45	24-5-47	273	19	6,807	5·97	406·49	M. B. Stott	Juadine Sparkles' Wonder (18659)
Colmyn Jewel	Jersey		2-9-45	20-8-47	273	13	6,609	6·13	405·64	C. M. Ironmonger	Eungella Prince Starbright (19538)
Grassvale Golden Cream 28th	Jersey		20-6-45	14-9-47	273	25	6,915	5·82	402·90	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Travalgan Starbright 28th	Jersey		16-4-45	3-7-47	273	17	7,311	5·36	391·98	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Valliere Marilyn	A.I.S.		14-7-45	26-5-47	273	10	9,570	4·03	385·84	M. L. House	Glanavon Ricardo (8116)
Denmark Golden Acette	Guernsey	12681	28-6-44	12-12-46	273	18·5	5,845	6·57	384·58	Denmark Research Station	Denmark Ace (5738)
Kapara Happy Days 3rd	Jersey		9-7-45	6-8-47	273	19	7,167	5·32	381·67	D. Bradford	Congelin Mandarin (14542)
Eungella Marlene	Jersey		1-4-45	28-4-47	273	15	6,915	5·34	369·15	D. G. Spark	Hopleand's Marinora's Star (20814)
Grassvale Buttercup 19th	Jersey		3-7-45	19-8-47	273	25·5	8,011	4·59	367·88	R. H. Rose & Son	Glen Iris Golden Oxford (12694)
Muresk Diadem	Guernsey	13924	7-5-44	2-11-46	273	25	6,915	5·31	367·22	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Montaro Princess	A.I.S.	..	30-6-44	12-11-46	273	33	8,529	4·22	360·39	M. H. Montgomery	Glanavon Tudor (8123)
Kapara Sweet Briar	Jersey		22-6-45	19-6-47	273	19	7,227	4·97	359·85	D. Bradford	Congelin Mandarin (14542)
Travalgan Lady Eion 29th	Jersey		19-5-45	7-9-47	273	14	5,922	6·07	359·54	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Grassvale Northwood Maggie	Jersey		13-10-44	8-11-46	273	22·5	6,967	5·14	358·53	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Wooroloo Lulu	A.I.S.		14-10-44	25-10-46	273	30	8,250	4·34	358·37	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Carydale Royal Joy	Jersey		22-3-45	30-3-47	273	12	5,346	6·60	352·94	G. Layman	Juadine Royal (20841)
Colmyn Julienne	Jersey		4-6-45	29-7-47	273	10·5	5,911	5·92	350·49	C. H. Ironmonger	Eungella Prince Starbright (19538)
Valliere Annette	A.I.S.		2-4-45	6-3-47	273	20	8,655	4·04	349·95	M. L. House	Valliere Skipton (7595)
Muresk Dixie	Guernsey	13927	21-7-45	12-6-47	273	18	6,744	5·15	347·06	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Wooroloo Heatherbell 3rd	A.I.S.		5-10-44	25-10-46	273	33	8,259	4·10	346·52	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Trelawney Lightly	Jersey		26-7-45	27-4-47	273	19	6,087	5·63	342·86	J. C. Bushell	Greenmount Golden Patch (19603)
Kapara Jolly Handsome 2nd	Jersey		7-7-45	5-6-47	273	17	6,441	5·28	340·64	D. Bradford	Congelin Washington (18426)
Kapara Sparkle's Lassie 4th	Jersey		12-7-45	14-7-47	273	18	6,564	5·14	337·52	D. Bradford	Congelin Washington (18426)
Claremont Belle 44th	A.I.S.		1-3-45	5-7-47	273	20	7,080	4·76	337·48	Claremont Hospital for Insane	Glanavan Dunster (6867)
Travalgan Lady Eion 30th	Jersey		21-6-45	26-6-47	273	15	6,005	5·60	336·75	W. H. & T. F. Robinson	Mornmoot Laver (17792)

Trelawney Radium Lassie	Jersey	.	1-8-45	20-5-47	273	17	4,791	6·97	334·30	J. C. Bushell	Greenmount Golden Patch (19603)
Glanavon Fairy 12th ...	A.I.S.	....	6-4-45	18-7-47	273	21	8,103	4·12	334·13	D. Bevan & Sons . .	Blacklands Jean's Supreme (1871)
Muresk Lady Ideal	Guernsey	13940	12-2-45	15-5-47	273	21	6,273	4·85	333·42	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Muresk Fay	Guernsey	13929	20-5-45	4-6-47	273	19	7,662	4·34	332·74	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Travalgan Starbright 30th.	Jersey	. .	8-6-45	27-6-47	273	17	5,991	5·55	332·69	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Grassvale Lady Fowler 43rd. .	Jersey	. .	25-9-44	8-11-46	273	16	6,468	5·08	328·93	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Claremont Biddy 78th ...	A.I.S.	.	29-5-44	15-11-46	273	29·5	8,233	3·93	323·75	Claremont Hospital for Insane	Westby Monarch (5404)
Yalebra Roma .	Jersey		19-7-45	30-4-47	273	17 5	6,382	5 02	320·50	K. V. Gray .	Greenmount Golden Patch (19603)
Grassvale Nora's Beauty .	Jersey	.	31-7-45	4-9-47	273	14	5,697	5 56	317·05	R. H. Rose & Son .	Glen Iris Golden Oxford (12694)
Travalgan Starbright 29th .	Jersey	. .	22-5-45	9-7-47	273	15	5,565	5·68	316·34	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Grassvale Buttercup 18th	Jersey		5-11-44	2-2-47	273	16 5	5,869	5 36	314 68	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Wooroloo Model 2nd .	A.I.S.	.	26-6-44	19-10-46	273	19	7,407	4·20	311 58	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Grassvale Golden Cream 27th	Jersey	.	26-9-44	1-2-47	273	12 5	6,007	5·15	309·45	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Radyr Park Dorothy 34th ..	Jersey	...	21-6-45	17-8-47	273	17	5,766	5 32	306·91	L. M. Temple ...	Radyr Park Estralita 2nd Starlight (21187)
Travalgan Starbright 31st .	Jersey		12-6-45	15-7-47	273	13	5,139	5·93	305·05	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Claremont Cherry 39th .	A.I.S.	.	15-10-44	15-3-47	273	19	7,0?2	4·25	300·42	Claremont Hospital for Insane	Westby Monarch (5404)
Claremont Pinafore 21st . .	A.I.S.	. .	1-1-45	26-4-47	273	23	7,779	3·85	300·09	Claremont Hospital for Insane	Westby Monarch (5404)
Korijekup Lilian	Jersey	...	3-6-45	26-8-47	273	11	4,398	6·81	299·79	Mrs A. G. Eckersley .	Navua Royal Star (15869)
Claremont Belle 43rd	A.I.S.	.	19-10-44	18-1-47	273	22 5	7,477	3·97	297·27	Claremont Hospital for Insane	Westby Masterpiece (5403)
Claremont Cleggett 28th	A.I.S.		16-8-44	27-10-46	273	24 5	7,228	4 10	296 67	Claremont Hospital for Insane	Westby Masterpiece (5403)
Plenarbor Lovely .	A.I.S.		14-4-44	30-8-47	273	23	7,299	4 06	296·12	Mrs. V. Alexander . .	Glanavan Genius (3957)
Durrinba Temple Belle	Jersey		24-8-45	30-5-47	273	13	5,304	5 56	295 38	F. Campbell	Radyr Park September Lad (14023)
Yalebra Lady .	Jersey	....	15-8-45	6-9-47	273	9	5,337	5 53	295 21	K. V. Gray .	Mokine Reserve (21017)
Claremont Clara 24th	A.I.S.	.	13-8-44	30-10-46	273	22 5	7,012	4 18	293 40	Claremont Hospital for Insane	Claremont Vincent (6715)
Claremont Maggie Morrison 63rd	A.I.S.		15-10-44	16-3-47	273	23	7,404	3·94	291 86	Claremont Hospital for Insane	Westby Masterpiece (5403)
Claremont Biddy 81st	A.I.S.		11-10-44	14-4-47	273	23	7,719	3 77	291 52	Claremont Hospital for Insane	Westy Monarch (5404)
Mereworth Dreaming Fondant	Jersey		31-5-44	9-6-47	273	8 5	5,875	4 92	289 41	B. Langridge	Navua Coronation Star (14929)
Glanavon Penelope 4th	A.I.S.		11-11-44	14-2-47	273	24	6,912	4·15	287 00	D. Bevan & Sons .	Glanavon Fairy's Triumph (8105)
Grassvale Design's Magnolia	Jersey		5-11-44	22-10-46	273	12	5,541	5 16	286 23	R H Rose & Son	Mornmoot Northwood Beau (17798)
Muresk June	Guernsey	13938	9-8-45	1-6-47	273	16 5	6 544	4·36	285 44	J. R Giles	Koojan Ideal's Dictator (4167)
					365	13 5	7,927	4 58	363 08		
Wattle Hill Cinderella	A.I S.		12-4-45	29-8-47	273	18	6,729	4·23	285·25	K. Prowse	Capel Cinderella King 2nd (7892)
Muresk Adeline .	Guernsey	13919	7-9-44	25-11-46	273	25	6,480	4 38	284·11	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Glanavon Rene 4th	A I.S.		27-10-44	26-3-47	273	22	7,386	3 84	283·60	D. Bevan & Sons . .	Blacklands Jean's Supreme (1871)
Kapara Carnation .	Jersey	..	7-6-45	20-6-47	273	14	5,562	5·08	282·54	D Bradford . -	Congelin 'Mandarin (14542)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
				COWS UNDER 2½ YEARS OLD. STANDARD 230 lb. BUTTERFAT.							
Camden Sheba	Jersey		5-2-45	23-7-47	273	10	4,620	6·08	281·75	C. E. Kruger	Greenmount Starbright (20748)
Glanavon Glenys 5th	A.I.S.		9-9-44	5-2-47	273	21	6,963	4·04	281·62	D. Bevan & Sons	Blackland's Jean's Supreme (1871)
Walgett Joyce	Jersey		28-6-45	30-8-47	273	11·5	5,029	5·59	280·99	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Claremont Cherry 38th	A.I.S.		9-7-44	6-11-46	273	24	7,512	3·73	280·54	Claremont Hospital for Insane	Westby Masterpiece (5403)
Glanavon Ettie 11th	do.		10-2-45	5-7-47	273	14	6,642	4·21	279·90	D. Bevan & Sons	Blackland's Monarch Commander (1877)
Eungella Little Gem	Jersey		22-5-45	25-4-47	273	12	5,181	5·39	279·58	D. G. Spark	Hopeland's Marinora Star (20814)
Claremont Whitby Maiden 4th	A.I.S.		7-1-45	16-4-47	273	22·5	6,727	4·13	277·85	Claremont Hospital for Insane	Glanavon Dunster (4867)
Walgett Tudor Rose	Jersey		17-4-45	8-5-47	273	11·5	5,164	5·36	277·02	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Claremont Maggie 22nd	A.I.S.		30-9-44	12-11-46	273	21	6,723	4·10	276·17	Claremont Hospital for Insane	Glanavon Dunster (4867)
Denmark Rosemary 2nd	Guernsey	12702	14-10-44	2-12-46	273	14·5	4,483	6·13	275·06	Denmark Research Station	Koojan Ideal's Reflection (4974)
Radyr Park Dorothy 33rd	Jersey		10-6-45	1-8-47	273	9	5,127	5·35	274·59	L. M. Temple	Radyr Park Estrellita 2nd Starlight (21187)
Kapara Duchess 3rd	do.		27-6-45	6-6-47	273	14	5,097	5·38	274·34	D. Bradford	Congelin Washington (18426)
Eungella Miss Marinora	do.		15-6-45	9-5-47	273	10·5	5,056	5·39	272·58	D. G. Spark	Hopelands' Marinora's Star (20814)
Claremont Whitby Maid 60th	A.I.S.		13-8-44	6-11-46	273	22	6,906	3·94	272·15	Claremont Hospital for Insane	Westby Monarch (5404)
Claremont Maggie Morrison 66th	do.		23-12-44	23-2-47	273	24	6,957	3·89	270·91	Claremont Hospital for Insane	Westby Monarch (5404)
Eungella Crystal Lily	Jersey		4-4-45	23-7-47	240	11	5,250	5·15	270·48	D. G. Spark	Hopeland's Marinora's Star (20814)
Tipperary Tulip	A.I.S.		2-11-45	14-9-47	273	20	6,630	4·06	269·19	W. G. Burges	Tipperary Performer (7572)
Claremont Maggie Morrison 56th	do.		15-12-44	23-2-47	273	21	7,203	3·72	268·06	Claremont Hospital for Insane	Westby Masterpiece (5403)
Travalgan Lady Eion 33rd	Jersey		6-10-45	11-8-47	273	11	4,983	5·31	264·80	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Radyr Park Dorothy 32nd	do.		1-5-45	8-6-47	273	10	4,740	5·56	263·62	L. M. Temple	Radyr Park Estrellita 2nd Starlight (21187)
Claremont Mabel 33rd	A.I.S.		18-12-45	4-8-47	273	20	6,930	3·80	263·50	Claremont Hospital for Insane	Glanavon Dunster (6867)
Claremont Mavis 11th	do.		12-9-44	25-10-46	273	18	6,729	3·88	261·66	Claremont Hospital for Insane	Westby Masterpiece (5403)
Glanavon Charmer 5th	do.		30-10-44	5-2-47	273	22	5,841	4·43	259·17	D. H. Bell	Blackland's Jean's Supreme (1871)
Claremont Biddy 84th	do.		15-12-44	20-4-47	273	15	6,030	4·28	258·55	Claremont Hospital for Insane	Westy Monarch (5404)
Glanavon Rosette 7th	do.		9-9-44	10-2-47	273	16	5,898	4·38	258·39	D. Bevan & Son	Glanavon Fairy's Triumph (8105)
Tipperary Beauty 22nd	do.		19-12-44	15-3-47	273	17	6,291	4·09	257·78	W. G. Burges	Liberton Venturer 2nd (7132)
Travalgan Lady Eion 28th	Jersey		18-5-45	21-6-47	273	13	4,689	5·47	256·95	W. H. & T. F. Robinson	Mornmoot Laver (17792)

Walgett Easter Tulip ..	do.		8-4-45	16-6-47	273	9	5,262	4·88	256·85	C. J. Cunningham ...	Selsey Wyandotte's Prince (18058)
Travalgan Lady Elon 34th .	do.		7-10-45	1-8-47	273	7	4,161	6·15	256·01	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Claremont Cherry 41st .	A.I.S.		14-12-44	24-1-47	273	21	6,363	4·01	255·39	Claremont Hospital for Insane	Westby Monarch (5404)
Claremont Blossom 44th .	do.	..	16-11-45	20-4-47	273	18·5	6,595	3·84	253·42	Claremont Hospital for Insane	Westby Monarch (5404)
Claremont Beauty 31st .	do		19-10-44	21-1-47	273	21·5	7,069	3·56	252·31	Claremont Hospital for Insane	Glanavon Dunster (6867)
Eungella Jessamine	Jersey		12-5-45	22-4-47	273	11	5,073	4·94	251·08	D. G. Spark . .	Hopeland's Marinora's Star (20814)
Claremont Maggie 20th	A.I.S.		17-7-44	5-11-46	273	22·5	6,667	3·73	249·00	Claremont Hospital for Insane	Westby Masterpiece (5403)
Glanavon Melba 8th	do		12-4-45	26-7-47	273	11	6,213	4·00	248·85	D. Bevan & Sons	Glanavon Fairy's Triumph (8105)
Claremont Pinafore 20th	do		6-9-44	16-11-46	273	21	6,468	3·82	247·22	Claremont Hospital for Insane	Westby Masterpiece (5403)
Tipperary Lovely 11th .	do		2-6-45	17-3-47	273	11	6,183	3·97	245·48	W. G. Burges	Tipperary Ace (6336)
Claremont Cherry 44th	do.		4-5-45	30-7-47	273	16	6,243	3·92	244·76	Claremont Hospital for Insane	Westby Monarch (5404)
Kiama Bess 20th	do.		11-4-45	25-5-47	273	13	6,009	4·03	242·35	M. H. Montgomery	Kiama Ronel (7079)
Carbanup Helen	do.		7-3-45	30-3-47	240	30·5	7,125	3·39	242·13	D. H. Bell .	Newstead Royal Sun (7252)
Denmark Standard's Dawn .	Guernsey	12704	28-9-46	9-12-46	273	12	3,516	6·84	240·74	Denmark Research Station	Denmark Valencia's Standard (5767)
Eungella Pepita ..	Jersey		28-6-45	29-4-47	273	11	4,533	5·28	239·55	D. G. Spark .	Hopeland's Marinora's Star (20814)
Montaro Empress	A.I.S.	52251	18-2-45	15-5-47	240	17	5,325	4·49	239·43	J. H. Bensted & Co.	Glanavon Tudor (8123)
Walgett Handsome Girl 41st	Jersey		4-8-45	18-8-47	273	12·5	4,747	5·04	239·32	C. J. Cunningham ..	Selsey Wyandotte's Prince (18058)
Radyr Park Estrellita 6th .	do.		1-10-45	12-7-47	273	8	3,744	6·32	236·96	L. M. Temple	Radyr Park September Lad (825)
Claremont Star 35th	A.I.S.		6-11-44	25-1-47	273	18	6,159	3·79	233·74	Claremont Hospital for Insane	Westby Masterpiece (5403)
Mayvale Discoverer's Bluebell 3rd	Guernsey	13659	28-7-44	25-11-46	273	7·5	4,537	5·11	232·29	R. J. Giles .	Koojan Ideal's Discoverer (4968)
Carbanup Heiress	A.I.S.		10-3-45	8-4-47	240	25·5	6,470	3·52	231·84	D. H. Bell .	Newstead Royal Sun (7252)
Claremont Whitby Maid 62nd	do.		2-4-45	7-8-47	273	15	6,375	3·62	230·67	Claremont Hospital for Insane	Glanavon Dunster (6867)
Radyr Park Estrella .	Jersey	.	23-6-45	22-7-47	273	7	4,116	5·56	228·90	L. M. Temple .	Radyr Park Estrellita 2nd's Starlight (21187)
Claremont Hilda 19th	A.I.S.		22-3-45	5-7-47	273	16	6,318	3·62	228·80	Claremont Hospital for Insane	Westby Masterpiece (5403)
Claremont Maggie Morrison 69th	do.	.	1-2-45	5-7-47	273	13	5,574	4·08	227·47	Claremont Hospital for Insane	Westby Masterpiece (5403)
Rosella Twinkle	Guernsey	14413	5-6-45	22-7-47	210	7	4,935	4·57	225·96	Darnell Brothers .	Cranbourne Charlie (3993)
Kapara Rosebud 3rd	Jersey		2-8-45	23-6-47	273	7	4,011	5·68	225·82	D. Bradford	Grassvale Twylish Lad (21816)
Wondella Fleur 6th .	do.		24-10-45	17-8-47	273	12	4,671	4·83	225·81	B. C. H. Hack .	Kapara Jolly Roger
Kapara Peerless Lily	do		31-3-45	13-6-47	273	10	4,350	5·18	225·33	D. Bradford .	Congelin Mandarin (14542)
Radyr Park October Star 3rd	do.		23-7-45	18-8-47	273	6	4,158	5·36	222·85	L. M. Temple ..	Radyr Park Estrellita 2nd Starlight (21187)
Claremont Whitby Maid 61st	A.I.S.		23-12-44	23-6-47	273	14	6,207	3·58	222·51	Claremont Hospital for Insane	Westby Masterpiece (5403)
Rosella Twylight	Guernsey	14412	5-6-45	13-8-47	210	5·5	4,170	5·28	220·41	Darnell Brothers .	Cranbourne Charlie (3993)
Rutherwood Annette	do	14481	15-4-45	1-8-47	273	10	4,185	5·20	217·66	Misses E. & I. Rutherford	Koojan Ace's Sunshine (5942)
Narrogin Princess Pearl	A.I.S.		8-9-45	28-6-47	210	21·5	5,415	4·00	217·11	J. Bensted & Co. .	Wooroloo Gay Gordon (8878)
Lenmoor's Maggie 2nd	do		10-9-45	23-8-47	240	8	5,145	4·14	213·49	G. W. Marston ...	Wooroloo Union Jack (7662)
Carbanup Honey	do.		21-2-45	8-4-47	240	22·5	5,745	3·67	211·14	D. H. Bell ..	Newstead Royal Sun (7252)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS UNDER 2½ YEARS OLD. STANDARD 230 LBS. BUTTERFAT.											
Tipperary Topsy	A.I.S.		14–11–45	3–9–47	273	12	4,976	4·22	210·25	W. G. Burges	Tipperary Performer (7572)
Denmark Golden Dawn 3rd	Guernsey	12682	29–9–44	10–12–46	273	9	3,747	5·59	209·54	Denmark Research Station	Koojan Ideal's Reflection (4974)
Tipperary Lovely 10th	A.I.S.		18–11–44	16–1–47	273	7	4,851	4·21	204·41	W. G. Burges	Liberton Venturer 2nd (7132)
Plenarbor Tottie	do.		26–5–44	15–11–46	273	22	5,091	3·99	203·13	Mrs. V. Alexander	Glanavon Genius (3957)
Wykeham Heroine	Jersey		31–8–45	27–6–47	210	12	4,155	4·84	201·36	K. V. Gray	Wykeham Gentle Lad (22508)
Tipperary Milkmaid	A.I.S.		23–11–45	21–9–47	240	18	5,070	3·92	198·95	W. G. Burges	Glanavon Povey (8114)
Claremont Clarie 5th	do.		25–12–44	12–6–47	273	17	5,391	3·68	198·56	Claremont Hospital for Insane	Westby Masterpiece (5403)
Narrogin Dixie	do.		10–1–45	20–3–47	273	12	4,881	4·04	197·58	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Tipperary Lovely 9th	do.		15–11–44	19–2–47	273	8	4,734	4·05	192·13	W. G. Burges	Liberton Venturer 2nd (7132)
Colliedale Biddy	Jersey		20–6–44	17–12–46	273	15·5	3,331	5·72	190·86	C. E. Kruger	Belgonia Peggy 6th's Aim (17263)
Rosella Daphne	Guernsey	14393	16–4–45	15–5–47	273	10	4,065	4·67	189·94	Darnell Brothers	Cranbourne Charlie (3993)
Narrogin Pamela	A.I.S.		9–2–45	17–5–47	273	9	4,737	3·99	189·32	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Narrogin Dolores	do.		12–5–45	30–3–47	273	11	4,698	4·02	189·13	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)
Glanavon Charmer 6th	do.		4–1–45	28–2–47	273	11	4,653	3·97	185·13	D. Bevan & Sons	Glanavon Fairy's Triumph (8105)
Rosella Opal	Guernsey	14402	26–7–45	23–8–47	180	9	3,630	5·07	184·29	Darnell Brothers	Cranbourne Charlie (3993)
Claremont Cleggett 29th	A.I.S.		7–3–45	4–8–47	210	18	4,830	3·79	183·18	Claremont Hospital for Insane	Glanavon Dunster (6867)
Radford Park Daisy	Jersey		28–5–45	17–8–47	180	10·5	4,500	4·06	182·70	Radford Park Company	Grassvale Golden Lad (19599)
Rutherwood Golden Twylight 2nd	Guernsey	14493	7–7–45	13–8–47	273	7	4,101	4·41	181·04	Misses E. & I. Rutherford	Rutherwood Golden Ideal (7971)
Glanavon Ettie 10th	A.I.S.		21–6–45	6–3–47	240	6	4,380	4·10	179·91	D. Bevan & Sons	Glanavon Fairy's Triumph (8105)
Rosella Heather	Guernsey	14396	18–6–45	24–5–47	240	6	3,705	4·81	178·35	Darnell Brothers	Cranbourne Charlie (3993)
Claremont Empress	A.I.S.		30–8–45	23–8–47	180	13	4,290	4·13	177·18	W. K. Barnes	Capel Monarch (7898)
Rosella Marigold	Guernsey	14399	9–6–45	7–8–47	210	5·5	3,315	5·31	176·25	Darnell Brothers	Cranbourne Charlie (3993)
Narrogin Lilac	A.I.S.		18–4–45	6–4–47	273	12	4,461	3·86	172·54	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Narrogin Mignon	A.I.S.		21–4–45	11–4–47	273	12	4,416	3·86	170·52	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Narrogin Mary	do.		31–3–45	20–3–47	273	12	4,476	3·72	166·74	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Carbanup Handsome	do.		1–3–45	22–4–47	210	22	4,665	3·52	164·28	D. H. Bell	Newstead Royal Sun (7252)
Narrogin Marlene	do.		7–4–45	20–3–47	273	10	3,945	3·84	151·78	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)
Narrogin Sadie	do.		13–4–45	23–3–47	273	9	3,702	4·02	149·18	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)
Wondella Annette	Jersey		15–11–45	25–8–47	210	5	2,835	5·09	144·33	B. C. H. Hack	Burlington Sultan (21613)
Narrogin Gem	A.I.S.		19–4–45	13–5–47	210	12	3,600	3·92	141·33	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)

Kapara Iolanthe 2nd	Jersey		12-7-45	14-7-47	150	13	2,490	5·6	140·19	D. Bradford	Congelin Mandarin (14542)
Mokine Empire's Lily 44th	do.		18-7-45	29-9-47	150	8·5	2,340	5·90	139·17	Davies & Sons	Mokine Reserve (21017)
Koojan Benoit's Jocelyn	Guernsey		18-12-45	5-10-47	180	9·5	2,490	5·45	135·93	R. J. Giles	Road's End Benoit (5211)
Rosella Token	do.	14410	8-8-45	27-9-47	150	7	3,060	4·32	132·24	Darnell Brothers	Cranbourne Charlie (3993)
Grassvale Golden Cream 29th	Jersey		15-8-45	29-8-47	120	19	2,730	4·81	131·55	K. V. Gray	Glen Iris Golden Oxford (12694)
Mokine Empire's Twylish 19th	do.		16-4-46	13-9-47	120	17	2,070	5·38	111·48	T. H. Wilding	Mokine Reserve (21017)
Yokanup Pansy 6th	A.I.S.		9-6-45	18-9-47	150	13	2,580	3·87	99·96	Burkitt & Brown	Glanavon Romancer (6878)
Yokanup Carnation 8th	do.		2-9-45	18-9-47	120	12	2,130	4·56	97·26	Burkitt & Brown	Glanavon Romancer (6878)
Travalgan Attraction	Jersey		1-8-45	25-11-47	60	26	1,590	6·09	96·96	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Wondella Butterfly 5th	do.		12-7-45	29-12-47	150	9	1,950	4·77	93·12	B. C. H. Hack	Kapara Jolly Roger
Denmark Reflection's Petal	Guernsey	12696	26-8-45	16-10-47	150	8·5	2,085	4·24	88·50	Denmark Research Station	Koojan Ideal's Reflection (4974)
Lansdowne Beaux Yeux	do.		20-12-44	17-6-47	90	21	1,920	4·14	79·62	J. R. Giles	Koojan Beau Ideal (4965)
Narrogin Dewdrop	A.I.S.		12-3-45	25-3-47	150	7	1,635	4·28	70·05	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Bindoon Brenda	do.		22-12-45	15-12-47	180	6	1,710	4·04	69·12	Christian Bros. Farm School	Emerald Vale Speculation (8032)
Granada Countess 17th	Jersey		6-8-45	5-6-47	60	22·5	1,305	5·16	67·44	R. G. Brazier	Austral Park Pioneer (16264)
Narrogin Astrid	A.I.S.		2-6-45	15-3-47	150	7	2,100	3·13	65·76	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)
Narrogin Charity	do.		11-5-45	27-3-47	120	7	1,440	3·84	55·35	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Rosella Sunbeam	Guernsey	14409	10-9-45	14-9-47	90	9	1,080	4·87	52·65	Darnell Brothers	Cranbourne Charlie (3993)
Narrogin Dawn	A.I.S.		3-4-46	22-2-48	60	19	1,410	3·68	52·02	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)
Granada Leticia 15th	Jersey		6-8-45	19-5-47	30	27	810	6·23	50·49	R. G. Brazier	Belgonia Royal Pride (21526)
Wondella Beauty	do.		18-8-45	12-8-47	90	6	1,140	4·16	47·49	B. C. H. Hack	Burlington Sultan (21613)
Rosella Sunlady	Guernsey		14-7-46	26-2-48	90	11·5	1,035	4·51	46·74	Darnell Brothers	Koojan Ace's Roosevelt (7439)
Drakesbrook Kidlet	do.	12755	29-4-45	13-10-47	30	13·5	555	4·48	24·87	R. J. Giles	Koojan Ace's Aviator (5930)
Narrogin Dorcas	A.I.S.		6-5-45	24-5-47	60	5	510	4·62	23·58	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Kapara Dairymaid 4th	Jersey		15-6-46	2-4-48	30	10·5	315	4·45	14·04	W. L. Bradford	Grassvale Twylish Lad (21816)

COWS 2½ YEARS AND UNDER 3 YEARS. STANDARD 250 LB BUTTERFAT

Grassvale Buttercup 17th	Jersey		1-10-44	5-5-47	273	26·5	9,394	5·22	490·86	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Denmark Ace's Velvet	Guernsey	12672	3-9-44	7-6-47	273	20	7,545	5·97	450·16	Denmark Research Station	Denmark Ace (5738)
Muresk Helianthus	do.	13933	9-12-44	22-6-47	273	26	8,598	5·22	449·60	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Capel Model 10th	A.I.S.		9-5-44	6-5-47	273	29	11,157	3·93	439·25	B. W. Prowse	Capel Star King (4672)
Mokine Daisy 4th	Jersey		24-10-44	10-9-47	273	19	7,407	5·84	432·75	T. H. Wilding	Mokine Reserve (21017)
Koojan Ace's Juliette	Guernsey	13501	29-5-44	8-12-46	273	20	8,130	5·24	426·58	R. J. Giles	Homestead Ace (1631)
Grassvale Northwood Maggie	Jersey		13-10-44	5-10-47	273	13	7,674	5·41	415·66	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Denmark Ace's Dawn 3rd	Guernsey	12671	22-10-44	23-5-47	273	15	6,975	5·95	415·04	Denmark Research Station	Denmark Ace (5738)
Tipperary Beauty 23rd	A.I.S.		6-1-45	14-9-47	273	30	10,560	3·91	413·45	W. G. Burges	Liberton Venturer 2nd (7132)
Capel Model 11th	do.		13-8-44	22-4-47	273	29	10,482	3·63	380·74	B. W. Prowse	Capel Rose's Commodore (6692)
Clovelly Blossom 2nd	Guernsey	12599	4-8-44	23-6-47	273	12	6,351	5·86	372·25	J. Cabassi	Denmark Rosa's Ace (5760)
Koojan Ace's Jane	do.	13493	5-7-44	12-4-47	273	14	6,402	5·67	363·49	A. W. Padbury	Homestead Ace (Imp.) (1631)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 2½ YEARS AND UNDER 3 YEARS. STANDARD 250 LB. BUTTERFAT.											
Valliere Viola	A.I.S.		7-7-44	7-6-47	240	15	8,040	4 43	356.13	M. L. House	Valliere Warrior (8816)
Camden Cleopatra 2nd	Jersey		20-8-44	1-6-47	273	15	5,475	6.44	352 66	C. E. Kruger	Greenmount's Starbright (20748)
Burlington Dairymaid 3rd	do.		1-9-44	15-6-47	273	12 5	6,262	5.52	345.95	Davies & Sons	Lawrenny Johnnie (16670)
Chillwell Zena's Buttercup	do.		14-8-44	11-4-47	273	14.5	6,193	5.50	341 23	Mrs. M. A. Watson	Grassvale Noramine's Beau (19600)
Capel Daphne's Pet	A.I.S.		10-9-44	28-7-47	273	23.5	9,160	3.68	337.16	B. W. Prowse	Capel Dove King (5579)
Yokanup Pansy 4th	do.		31-7-44	25-5-47	273	17	8,661	3.85	333 57	Burkitt & Brown	Glanavon Romancer (6878)
Muresk Waaf	Guernsey	13951	17-4-44	17-12-46	273	25	7,095	4.46	316 69	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Muresk Amethyst	do.	13920	21-7-44	11-6-47	273	17	6,426	4.86	312.16	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Glanavon Dell 7th	A.I.S.		12-8-44	12-6-47	273	14	7,212	4.28	311 07	D. Bevan & Sons	Blackland's Monarch's Commander (1877)
Muresk Rona	Guernsey	13946	9-6-44	15-1-47	273	16	7,008	4.40	308.74	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Grassvale Lady Fowler 41st	Jersey		3-4-44	8-11-46	273	11	5,748	5 35	307 65	K. V. Gray	Mornmoot Northwood Beau (17798)
Eungella Yileen	do.		27-4-44	27-4-47	273	14	7,152	4 27	305.61	D. G. Spark	Eungella Prince Starbright (19538)
Montaro Pansy	A.I.S.		14-2-45	22-8-47	273	17	6,891	4 35	299 81	M. H. Montgomery	Glanavon Tudor (8123)
Kapara Duchess 2nd	Jersey		18-6-44	3-5-47	273	18	5,874	5 10	299 69	W. L. Bradford	Congelin Jolly Eminent 3rd (18425)
Chillwell Godetia Gwen	do.		19-12-44	12-9-47	273	9 5	6,758	4.38	291.16	Mrs. M. A. Watson	Grassvale Noramine's Beau (19600)
Lenmoor's Della 5th	A.I.S.		14-8-44	28-7-47	273	5 5	6,496	4.40	286 41	G. W. Marston	Ferndale Radiant (5729)
Alne-Bank Fairy 36th	do.		9-12-44	26-6-47	273	15.5	6,946	4.11	285 43	G. W. Marston	Parkview Factor (5107)
Burlington Sweet Wonder	Jersey		21-8-44	4-5-47	240	11.5	4,575	6.12	280.02	Davies & Sons	Lawrenny Johnnie (16670)
Grassvale Lady Fowler 42nd	do.		27-8-44	24-7-47	210	11.5	4,845	5.56	269 82	K. V. Gray	Mornmoot Northwood Beau (17798)
Juadine Peerless Lily 24th	do.		18-5-44	15-1-47	273	16 5	4,759	5 58	265.72	K. V. Gray	Juadine Northwood Beau (19670)
Claremont Beauty 30th	A.I.S.		30-9-44	19-4-47	273	23	6,969	3.79	264.43	Claremont Hospital for Insane	Westby Monarch (5404)
Kapara Firefly 2nd	Jersey		5-8-44	2-5-47	273	13	5,814	4.53	263 92	W. L. Bradford	Congelin Mandarin (14542)
Glanavon Doris 20th	A.I.S.		20-1-45	13-8-47	273	14	6,252	4 21	263 22	D. Bevan & Sons	Glanavon Fairy Triumph (8105)
Glanavon Melba 7th	do.		31-5-44	25-3-47	273	25.5	7,306	3 60	263.18	D. H. Bell	Newstead Triumph (3420)
Claremont Biddy 83rd	do.		5-12-44	5-7-47	273	21	7,128	3 58	255.26	Claremont Hospital for Insane	Westby Monarch (5404)
Kapara Rose Bud 2nd	Jersey		28-5-44	26-5-47	273	6	4,563	5 59	255 24	W. L. Bradford	Congelin Jolly Eminent 3rd (18425)
Yokanup Pearl 2nd	A.I.S.		16-10-44	24-9-47	273	19	6,882	3.70	255 18	Burkitt & Brown	Parkview Commodore (306)
Plenarbor Graceful	do.		30-6-44	15-5-47	273	17.5	6.922	3.60	249 36	Mrs. V. Alexander	Glanavon Genius (3957)
Juadine March Flower 3rd	Jersey		5-11-44	15-7-47	240	4.5	4,935	4 94	243.99	Davies & Sons	Juadine Northwood Beau (19670)
Denmark Reflection's Dame 2nd	Guernsey	12694	25-9-44	31-5-47	273	10	4,590	5 27	241 95	Denmark Research Station	Koojan Ideal's Reflection (4974)
Montaro Fairy	A.I.S.		14-1-45	23-8-47	273	9	5.427	4 35	236.35	M. H. Montgomery	Glanavon Tudor (8123)
Mereworth Easter Rye 2nd	Jersey		21-12-44	30-8-47	240	6 5	4,260	5 27	224 76	B. Langridge	Navua Coronation Star (14929)
Rosella Gloria	Guernsey	14395	2-11-44	2-10-47	210	4	4,335	5 10	221.37	Darnell Brothers	Cranbourne Charlie (3993)
Kapara Sparkle's Victorious 2nd	Jersey		29-5-44	28-4-47	273	9.5	4,573	4 79	219.19	W. L. Bradford	Congelin Jolly Eminent 3rd (18425)

Rosalind Janet 8th	A.I.S.		15-10-44	2-9-47	273	8	5,349	4.08	218.28	W. K. Barnes	Wallatin Dandy (6370)
Yokanup Pansy 5th .	do.		5-9-44	31-5-47	273	12.5	6,172	3.51	216.80	Burkitt & Brown	Parkview Commodore (306)
Newstead Rapture 28th .	do.		20-4-44	30-3-47	240	20.5	6,315	3.32	209.67	D. H. Bell .	Newstead Dictator (6025)
Radford Park Boronia	Jersey		20-9-44	20-6-47	210	10	4,125	5.06	208.98	Radford Park Co.	Grassvale Golden Lad (19599)
Rutherwood Golden Beauty	Guernsey	14486	28-12-43	20-11-46	273	11.5	4,219	4.92	207.81	Misses E. & I. Rutherford	Denmark Golden Rippler (5751)
Kapara Sparkle's Lassie 3rd	Jersey		13-8-44	9-7-47	240	7.5	4,710	4.40	207.54	W. L. Bradford	Congelin Jolly Eminent 3rd (18425)
Narrogin Damsel .	A.I.S.		7-6-44	26-3-47	273	10	5,190	3.96	206.02	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Rosella Daffodil	Guernsey	14392	7-8-44	22-7-47	210	7	3,705	5.54	205.32	Darnell Brothers	Cranbourne Charlie (3993)
Plenarbor Pearl	A.I.S.		6-5-44	30-12-46	273	24.5	6,073	3.37	205.13	Mrs. V. Alexander	Glanavon Chief (6864)
Chillwell Julienne's Lily	Jersey		2-9-44	21-5-47	240	12	4,245	4.50	191.37	Mrs. M. A. Watson	Juadine Northwood Beau (19670)
Rosella Matilda	Guernsey	14400	23-9-44	24-7-47	210	6	3,705	5.04	186.99	Darnell Brothers	Cranbourne Charlie (3993)
Radyr Park Dorothy 31st	Jersey		7-12-44	5-9-47	240	8	3,660	5.02	183.99	L. M. Temple	Radyr Park Estrellita 2nd Starlight (21187)
Plenarbor Daisy 2nd	A.I.S.		5-3-44	4-1-47	273	20	5,175	3.52	181.27	Mrs. V. Alexander	Glanavon Genius (3957)
Montaro Dove	do.		15-3-44	15-1-47	180	27	4,770	3.72	177.69	M. H. Montgomery	Glanavon Vim (6882)
Newstead Lovely 28th	do.		28-8-44	10-8-47	120	34.5	4,605	3.82	176.25	D. H. Bell	Newstead Radiant (8477)
Mereworth Oxford Marina	Jersey		20-9-44	28-7-47	273	3.5	4,315	4.54	175.29	B. Langridge	Mereworth Easter Oxford (22023)
Trelawney Flash	do.		15-8-44	15-4-47	210	13	3,330	5.08	169.17	F. Campbell	Greenmount Golden Patch (19603)
Granada Primrose 2nd	do.		20-9-44	5-6-47	150	20.5	3,420	4.71	161.10	R. G. Brazier	Austral Park Pioneer (16264)
Tipperary Lovely 11th	A.I.S.		2-6-45	13-1-48	120	15	3,780	3.65	138.09	W. G. Burges	Tipperary Ace (6336)
Bindoon Flossette	do.		18-10-44	22-10-47	240	9	3,495	3.79	132.54	St. Joseph's Farm School	Wooroloo Freddie (8876)
Wattle Creek Pretty	do.		6-5-44	20-2-47	120	25	3,000	4.30	129.03	E. T. Thatcher	Glanavon Duncan (6866)
Rosella Wallflower	Guernsey	14414	9-9-44	5-9-47	180	5.5	2,790	4.60	128.49	Darnell Brothers	Cranbourne Charlie (3993)
Capel Pretty Vision 2nd	A.I.S.		14-6-44	28-4-47	90	21	2,055	4.11	84.57	B. W. Prowse	Capel Rose's Commodore (6692)
Chillwell Hovea Madeira	Jersey		29-10-44	16-5-47	90	16	1,500	4.65	69.84	Mrs. M. A. Watson	Grassvale Noramine's Beau (19611)
Travalgan Lady Eion 28th	do.		18-5-45	17-5-48	30	26	780	5.44	42.48	W. H. & T. F. Robinson	Mornmoot Laver (17792)
Capel Empress 2nd	A.I.S.		10-7-44	3-6-47	30	30	900	4.06	36.60	B. W. Prowse	Capel Rose's Commodore (6692)
Narrogin Sadie	do.		13-4-45	1-3-48	30	23	690	3.86	26.64	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)
Narrogin Gem	do.		19-4-45	27-2-48	30	24	720	3.05	21.96	Narrogin School of Agriculture	Wooroloo Gay Gordon (8878)

COWS 3 YEARS AND UNDER 3½ YEARS STANDARD 270 LB. BUTTERFAT.

Juadine Peerless Lily 23rd	Jersey		27-4-44	8-8-47	273	23	9,329	5.90	551.27	M. B. Stott ..	Juadine Northwood Beau (19670)
Denmark Bonnie Marie	Guernsey	12675	30-11-43	2-6-47	273	14	8,022	5.56	446.74	Denmark Research Station	Denmark Marie's Ruler (5756)
Juadine Jewel 5th	Jersey		29-1-44	29-5-47	240	22	8,890	4.97	441.69	G. Layman	Juadine Northwood Beau (19670)
Carydale Royal Daisy	do.	758	4-3-44	24-6-47	210	19	6,120	6.97	426.90	G. Layman	Juadine Royal (20841)
Grayleigh Precious Gem 3rd	A.I.S.		29-9-43	17-1-47	273	34	10,902	3.89	424.19	W. G. Burges	Grayleigh Wooton (4016)
Capel Queen's Maid	do.		30-4-44	16-5-47	273	18	9,309	4.23	393.99	B. W. Prowse	Capel Star King (4672)
Mokine Empire's Twylish 17th	Jersey		10-4-44	19-6-47	273	20	6,150	6.24	383.51	T. H. Wilding	Mokine Triumph (21019)
Riverglen Clarabelle 67th	A.I.S.		17-4-44	1-5-47	273	23	9,069	4.20	381.76	M. H. Montgomery	Kiama Chief (4098)
Muresk Jessica	Guernsey	13935	26-7-44	1-10-47	273	19	7,797	4.78	373.07	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Valliere Dairymaid	A.I.S.	47673	8-4-44	22-6-47	210	25	9,540	3.91	363.60	J. Bensted & Co. ...	Valliere Skipton (7595)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 3 YEARS AND UNDER 3½ YEARS OLD—STANDARD 270 LB. BUTTERFAT.											
Juadine Julienne 4th	Jersey		28-5-44	28-7-47	273	10.5	6,601	5.47	361.59	K. V. Gray	Juadine Northwood Beau (19670)
Lenmoor's Red Queen	A.I.S.		18-8-43	1-10-46	273	26	8,868	4.01	356.44	G. W. Marston	Ferndale Radiant (5729)
					365	29	11,440	4.13	472.63		
Muresk Awas	Guernsey	13921	25-5-44	14-7-47	273	18	8,484	4.19	355.81	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Grassvale Silvermine 3rd	Jersey		15-10-43	22-10-46	273	8.5	6,055	5.84	353.63	R. H. Rose & Sons	Mornmoot Northwood Beau (17798)
Wattle Hill Roan Queen	A.I.S.		6-5-44	17-5-47	273	26	8,778	4.00	351.63	K. Prowse	Wallatin Ninety Six (7607)
					365	20	10,615	4.05	430.40		
Radyr Park Dorothy 29th	Jersey		12-7-44	20-9-47	273	14	6,312	5.53	349.20	L. M. Temple	Radyr Park Estrellita 2nd Starlight (21187)
Muresk Veronica	Guernsey	13950	3-7-44	16-9-47	273	23	6,549	5.28	346.32	Muresk Agricultural College	Koojan Ideal's Dictator (4167
Kapara Dairymaid 2nd	Jersey		14-5-44	2-8-47	273	15.5	7,396	4.59	339.52	W. L. Bradford	Congelin Jolly Eminent 3rd (18425)
Grassvale Magnolia 6th	do		3-4-44	25-8-47	273	6	6,288	5.23	329.14	R. H. Rose & Sons	Mornmoot Northwood Beau (17798)
Mayvale Diana 2nd	Guernsey	13657	9-8-43	28-10-46	273	17	6,621	4.91	325.72	R. J. Giles	Koojan Ideal's Discoverer (4968)
Denmark Ruler's Rose	do	12703	5-1-44	23-5-47	273	13	6,519	4.94	322.57	Denmark Research Station	Denmark Marie's Ruler (5756)
Chillwell Model's Mignonette	Jersey		5-8-44	20-8-47	273	10.5	5,566	5.71	318.10	Mrs. M. A. Watson	Grassvale Noramine's Beau (19600)
Wattle Hill Princess	A.I.S.		20-5-44	23-9-47	273	21.5	8,854	3.55	314.37	K. Prowse	Wallatin Ninety Six (7607)
Valliere Valetta	do		1-6-44	6-6-47	273	11	7,503	4.14	310.74	M. L. House	Valliere Warrior (8816)
Camden Venus 2nd	Jersey		20-4-44	3-6-47	273	11	5,418	5.71	309.84	C. E. Kruger	Greenmount Starbright (20748)
Colliedale Lass	do.		12-6-44	12-8-47	240	15	6,195	4.96	307.41	C. E. Kruger	Belgonia Peggy 6th Aim (17263)
Carbanup Grace	A.I.S.		12-2-44	29-5-47	180	40.5	7,590	3.98	302.34	D. H. Bell	Glanavon Maestro (4833)
Grassvale Lady Fowler 41st	Jersey		3-4-44	25-9-47	240	7	5,580	5.27	294.54	K. V. Gray	Mornmoot Northwood Beau (17798)
Camden Charmaine	do.		11-7-43	8-10-46	240	10	5,295	5.74	294.15	Mrs. A. G. Eckersley	Greenmount Golden Bobbie (18578)
Trelawney Buttercup	do.		10-5-43	22-10-46	273	12.5	4,717	6.21	293.32	K. V. Gray	Greenmount Golden Patch (19603)
Lenmoor's Biddy 2nd	A.I.S.		7-7-44	4-10-47	240	11	7,380	3.81	281.24	G. W. Marston	Wooroloo Union Jack (7662)
Clovelly Diana	Guernsey	12603	15-5-44	25-5-47	273	15.5	6,241	4.45	277.77	J. Cabassi	Lansdowne Polydymite (4995)
Kapara Sparkle 4th	Jersey		15-4-44	16-6-47	273	6	5,673	4.85	274.85	D. Bradford	Congelin Jolly Eminent 3rd (18425)
Mayvale Discoverer's Daffodil	Guernsey		20-1-44	1-7-47	273	6.5	4,324	6.33	273.65	R. J. Giles	Koojan Ideal's Discoverer (4968)
Yokanup Dahlia 2nd	A.I.S.		1-8-43	24-1-47	273	23	6,789	3.92	266.31	Burkitt & Brown	Parkview Commodore (306)
Tipperary Pretty Maid 3rd	do.		7-10-43	25-3-47	210	12	5,910	4.47	264.72	W. G. Burges	Tipperary Ace (6336)
Clovelly Twinkle	Guernsey	12620	30-4-44	19-5-47	273	15	5,010	5.19	260.22	J. R. Cabassi	Lansdowne Polydymite (4995)
Rutherwood Golden Dawn	do.	14488	15-4-44	29-8-47	273	11	5,328	4.86	256.08	Misses E. & I. Rutherford	Denmark Golden Rippler (5751)
Mereworth Winsome Starbright	Jersey		14-3-44	13-9-47	273	6.5	4,954	5.16	255.90	B. Langridge	Greenmount Starbright (20745)
Radyr Park Dorothy 27th	do.		19-6-44	16-8-47	273	7	4,581	5.57	255.06	L. M. Temple	Radyr Park Estrellita 2nd's Starlight (21187)
Radford Park Lily	do.		21-5-44	10-8-47	240	4	5,040	5.03	253.74	Radford Park Co.	Grassvale Golden Lad (19599)
Yokanup Lupin 3rd	A.I.S.		27-5-44	21-8-47	240	6	7,290	3.40	248.04	Burkitt & Brown	Parkview Commodore (306)
Emerald Vale Melba	do.		13-2-44	4-3-47	273	10	6,510	3.70	240.97	St. Joseph's Farm School	Scotch College Sir Nigel (8657)

Mereworth Coronation Vanilla	Jersey		22-3-44	30-4-47	273	11	4,788	5.02	240.81	B. Langridge	Navua Coronation Star (14929)
Kapara Valentine ...	do.		13-3-44	24-5-47	240	15	5,025	4.73	237.54	W. L. Bradford	Kapara Cream Sox (20860)
Kapara Bo-Peep 2nd	do.		17-5-44	14-7-47	240	12	4,320	5.27	227.67	D. Bradford	Congelin Jolly Eminent 3rd (18425)
Plenarbor Opal	A.I.S.		11-4-44	14-8-47	240	8 5	5,865	3.80	223.08	Mrs. V. Alexander ...	Glanavon Genius (3957)
Glanavon Rosette 6th	do.		19-2-44	15-6-47	273	11	5,103	4 28	218.60	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Yokanup Vida	do.		27-4-44	25-8-47	273	13	6,759	3.18	215 42	Burkitt & Brown	Parkview Commodore (306)
Radford Park Rose	Jersey		17-5-44	7-10-47	180	4	3,630	5.86	212 85	Radford Park Co.	Grassvale Golden Lad (19599)
Denmark Golden Acette	Guernsey	12681	28-6-44	19-12-47	120	18	3,060	6 82	208 79	Denmark Research Station	Denmark Ace (5738)
Lenmoor's Queen 5th	A.I.S.		20-6-44	15-8-47	240	4	6,045	3 44	208.26	G. W. Marston	Wooroloo Union Jack (7662)
Wooroloo Delys	do.		1-4-44	27-5-47	150	15	4,530	4 51	204.60	Wooroloo Sanatorium Farm	Wooroloo Top Gallant (7661)
Colliedale Biddy	Jersey		20-6-44	4-11-47	180	16 5	3,360	5 95	200 22	C. E. Kruger	Belgonia Peggy 6th's Aim (17263)
Mereworth Dreaming Silver-mine	do.		31-5-44	27 9-47	273	8 5	4,240	4.55	193 25	B. Langridge	Navua Coronation Star (14929)
Plenarbor Daffodil	A I.S.		22-4-44	23-10 47	240	8	4,260	4 31	183 99	Mrs. V. Alexander	Glanavon Genius (3957)
Mokine Empire's Lily 42nd	Jersey		2-8-44	1-9 47	210	7 5	3,570	5 11	182 66	Davies & Sons	Mokine Triumph (21019)
Carbanup Gold	A.I S.		1-3-44	2-7-47	150	34	5,385	3 38	182 49	D. H. Bell	Newstead Royal Sun (7252)
Plenarbor Toddles	do.		26-5-44	24-7-47	240	6 5	4,575	3 59	164 67	Mrs. V. Alexander	Glanavon Genius (3957)
Carbanup Gem	do.		19-6-44	29-7-47	120	36	4,620	3 49	161 67	D. H. Bell	Newstead Royal Sun (7252)
Lenmoor's Jean 2nd	do.		4-4-44	5-8-47	210	9	4,110	3 92	161.31	G. W. Marston	Ferndale Radiant (5729)
Wondella Butterfly 4th	Jersey		19-8-44	3-12-47	180	14	2,880	5 45	156 99	B. C. H. Hack	Radyr Park June Lad (20037)
Koojan Ace's Star	Guernsey	13508	11-6-44	11-8-47	120	23	2,970	5 02	149 31	R. J. Giles	Homstead Ace (Imp.) (1631)
Emerald Vale Handsome	A.I S.		11-11-43	11-3-47	210	6	3,600	4 11	148.05	St Joseph's Farm School	Scotch College Sir Nigel (8657)
Wooroloo Red Gum 2nd	do.		5-5-44	25-7-47	90	34	3,330	4 42	147.39	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Mayvale Discoverer's Bluebell 3rd	Guernsey	13659	28 7-44	1-10-47	180	6 5	3,600	3 99	143 64	R. J. Giles	Koojan Ideal's Discoverer (4968)
Denmark Daffodil	do.	12678	21-4-44	16-7-47	60	35	2,175	4 88	106.20	Denmark Research Station	Koojan Ideal's Reflection (4974)
Valliere Mimosa 2nd	A I S.		12-7-44	17 8-47	60	31	1,980	4 65	92 10	J. H. Bensted & Co.	Valliere Warrior (8816)
Muresk Rona	Guernsey	13946	9-6-44	7-12-47	30	29	870	4 66	40 56	Muresk Agricultural College	Koojan Ideal's Dictator (4167)

COWS 3½ YEARS AND UNDER 4 YEARS—STANDARD 290 LBS. BUTTER-FAT.

Grassvale Eve	Jersey		19 9-43	27-8-47	273	22 5	9,217	5 79	533 95	R. H. Rose & Son	Mornmoot Northwood Beau (1779)
Carydale Precious	do.		6-5-43	13-4-47	273	19	9,492	5 51	523 37	G. Layman	Hopelands Pattern (18624)
Capel Gibson Girl 2nd	A I.S		6-5-43	24-4-47	273	32	12,396	4 01	498.23	B. W. Prowse	Capel Star King (4672)
Koojan Ace's Diplomat	Guernsey	13489	28-8-43	31-8-47	273	18	8,064	5 97	481 56	A. W. Padbury	Homestead Ace (Imp.) (1631)
Travalgan Starbright 20th	Jersey		15-4-43	12-3-47	273	23	7,869	6.00	472 32	J. C. Bushell	Orphanage Cuba (17913)
Grassvale Design's Noella	do		20-10-43	2-9-47	273	15	9,225	5.09	470 42	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Valliere Memory	A.I S.		18-6-43	5-6-47	273	10	11,295	4.03	455 74	M. L. House	Wooroloo Noble 4th (6411)
Carydale Pretty Janis	Jersey	97783	20-4-43	3-4-47	273	11 5	8,434	5 36	452.38	G. Layman	Hopelands Pattern (18624)
Capel Pretty Vision	A.I.S.	42457	15-5-43	19-5-47	273	21 5	10,924	3.84	420 24	B. W. Prowse	Capel Dove King (5579)
Valliere Honey	do.		7-7-43	30-5-47	240	15	9,255	4 23	392.10	M. L. House	Alpha Vale Reward (4518)
Trelawney A.B	Jersey		27-4-43	4-4-47	273	22	7,791	5 03	392.03	J. C. Bushell	Greenmount Golden Patch (19603)
Denmark Dawn's Reflection-ette	Guernsey	12670	7-9-43	17-5-47	273	15 5	6,391	5.99	383.09	Denmark Research Station	Koojan Ideal's Reflection (4974)
Muresk Dinah ...	do.	13926	28-11-43	4-10-47	273	25	8,365	4.52	378.60	Muresk Agricultural College	Koojan Ideal's Dictator (4167)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 3½ YEARS AND UNDER 4 YEARS.—STANDARD 290 LBS. BUTTER FAT.											
Muresk Susanna	Guernsey	13948	29–11–43	1–7–47	273	19	7,767	4 82	374 83	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Camden Celeste	Jersey	97747	10–9–43	5–5–47	273	14	5,787	6 40	370 41	D. G. Spark	Greenmount Golden Bobbie (18578)
Juadine Queen 2nd	do.		2–1–44	30–7–47	273	6.5	6,139	5 94	364 81	K. V. Gray	Juadine Northwood Beau (19670)
Carbanup Flirt	A.I.S.		23–6–43	10–2–47	273	38 5	8,230	4 28	353 81	D. H. Bell	Newstead Royal Sun (7252)
Eungella Telopia	Jersey	98286	20–5–43	9–5–47	273	10.5	5,926	5 93	351 89	D. G. Spark	Travalgan Starbright King (18129)
Korijekup Nadine	do.		23–11–43	18–6–47	273	12	5.916	5.89	348 93	Mrs. A. G. Eckersley	Juadine Captain (20840)
Glanavon Fairy 8th	A.I.S.		24–3–43	26–10–47	273	19	7,977	4 32	345 32	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Clovelly Hazel	Guernsey	12608	14–8–43	2–7–47	273	11	6,933	4.89	339 31	J. Cabassi	Lansdown Polydymite (4995)
Grantville Blossom 5th	A.I S.		26–10–43	27–7–47	273	16	8,388	3 95	332 12	W. G. Burges	Swanlea Monarch 2nd (7514)
Carbanup Florrie	do.		25–6–43	1–2–47	273	29 5	9,313	3 56	331 85	D. H. Bell	Glanavon Maestro (4833)
Grassvale Magnolia 5th	Jersey	98526	16–10–43	13–8–47	240	5	6,525	5 04	329 01	R. H. Rose & Sons	Grassvale Gold Cup (20745)
Glanavon Pink Pearl 7th	A.I.S.		4–12–43	12–7–47	273	20	7,160	4 57	327 24	D. Bevan & Sons	Glanavon Limerick (6873)
Glanavon Maggie 3rd	do		22–7–43	24–5–47	273	17	8,811	3 66	322.89	Burkett & Brown	Blacklands Jean's Supreme (1871)
Tipperary Beauty 19th	do.	47486	4–11–43	28–5–47	273	24	8,502	3.74	318.72	W. G. Burges	Tipperary Ace (6336)
Tirano Madame	do.		22–5–43	2–3–47	273	24 5	8,053	3.93	316 81	J. H. Bensted & Co.	Chittering Prince (3800)
Grayleigh Precious Gem	do.		2–9–43	29–6–47	273	15	7,995	3 95	316 18	W. G. Burgess	Swanlea Bertie (5290)
Carbanup Florrie	do.		13–2–43	19–1–47	273	7 5	7,882	3 98	314.00	D. H. Bell	Glanavon Maestro (4833)
Camden Selena	Jersey	97749	28–9–43	28–4–47	273	13	5,604	5.51	309.19	D. G. Spark	Greenmount Golden Bobbie (18578)
Walgett Ranunculas	do.		26–5–43	2–4–47	273	18	6,339	4 85	307.52	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Glanavon Rebecca	A.I S		25–9–43	17–7–47	273	14	7,572	4.01	303.72	D. Bevan & Sons	Newstead Triumph (3420)
Clovelly Lola	Guernsey	12612	7–9–43	28–5–47	273	15	6,435	4 62	297.38	J. Cabassi	Lansdowne Polydymite (4995)
Walgett Handsome Girl 32nd	Jersey		21–4–43	12–4–47	273	14	5,382	5.48	294.94	C. J. Cunningham	Selsey Wyandottes' Prince (18058)
Mokine Empire's Lily 41st	do.		10–10–43	23–4–47	273	6 5	5,389	5.45	294.01	Davies & Son	Mokine Royal Dick (21018)
Korijekup Royal Lady	do.		25–2–43	22–1–47	273	14	5,592	5 ·16	288.87	Mrs. A. G. Ekersley	Navau Royal Star (15869)
Mereworth Oxford Vanilla 3rd	do.	99301	30–4–43	21–4–47	273	14	5,322	5.42	288.80	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Glanavon Goldilocks 8th	A.I.S.		11–10–43	26–5–47	273	6	7,098	4.05	287 37	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Kapara Firefly	Jersey	98816	11–8–43	21–6–47	273	5	5,400	5 ·22	282 ·16	W. L. Bradford	Congelin Mandarin (14542)
Glanavon Lulu 4th	A.I S.		4–9–43	23–8–47	273	15	6,195	4 ·40	272 ·58	D. Bevan & Sons	Newstead Triumph (3420)
Rutherwood Golden Butterfly	Guernsey	14487	22–1–44	31–8–47	273	10 ·5	4,876	5 ·52	269 56	Misses E. & I. Rutherford	Denmark Golden Rippler (5751)
Grantham Silvermine 4th	Jersey	98518	21–11–43	31–8–47	273	14 ·5	6,073	4 ·34	263 ·72	B. Langridge	Rosecliffe Marchalong (15094)
Rosella Pauline	Guernsey	14403	8–8–43	15–5–47	273	7	4,941	5 34	263 ·75	Darnell Brothers	Cranbourne Charlie (3993)
Camden Milkmaid	Jersey		9–12–43	25–6–47	273	12	4,986	5 ·12	255 ·60	C. E. Kruger	Greenmount Starbright (20748)
Glanavon Rosina 7th	A.I.S.		25–9–43	5–6–47	273	11	6,843	3 ·72	254 ·40	Burkitt & Brown	Glanavon Limerick (6873)
Rosella Bloom	Guernsey	14391	1–9–43	23–5–47	210	15	5,160	4 ·86	250 ·68	Darnell Brothers	Cranbourne Charlie (3993)
Mokine Empire Lily 40th	Jersey		27–9–43	23–6–47	273	8 ·5	5,470	4 ·54	249 ·70	Davies & Sons	Mokine Royal Dick (21018)
Carbanup Fay	A.I.S.		17–8–43	3–6–47	180	36 ·5	7,275	3 ·41	248 ·28	D. H. Bell	Newstead Royal Sun (7252)
Wooroloo Gladys 3rd	do.	...	10–2–43	19–12–46	273	11	5,373	4 ·53	243 ·86	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)

Tipperary Lady May 6th	do.		8-5-43	17-3-47	240	5	6,060	4·00	242·55	W. G. Burgess	Tipperary Ace (6336)
Glanavon Dahlia 19th	do.		6-8-43	18-7-47	273	5	5,865	4·12	241·57	D. Bevan & Sons	Newstead Triumph (3420)
Tirano Shirley	do		1-7-43	5-3-47	273	13	5,844	4·07	237·85	J. H. Bensted & Co.	Chittering Prince (3800)
Glanavon Thelma 6th	do		15-10-43	16-9-47	273	14	6,162	3·85	237·28	D. Bevan & Sons ..	Glanavon Limerick (6873)
Grassvale Buttercup 14th	Jersey	98523	7-9-43	15-6-47	150	13	4,080	5·81	237·21	R. H. Rose & Son ...	Grassvale Gold Cup (20745)
Carbanup Fancy	A.I.S.		15-3-47	17-2-47	273	22·5	6,362	3·72	237·14	D. H. Bell	Newstead Royal Sun (7252)
Rosella Ladybird	Guernsey	14398	29-11-43	15-8-47	120	10·5	4,875	4·83	235·38	Darnell Brothers	Cranbourne Charlie (3993)
Lenmoor's Peggy 2nd	A.I.S.		15-1-44	26-7-47	273	3·5	5,190	4·44	230·57	G. W. Marston	Ferndale Radiant (5729)
Mereworth Oxford Makinora	Jersey		28-6-43	22-4-47	273	10	4,575	4·97	227·56	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Clovelly Diamond	Guernsey	12602	10-6-43	2-5-47	273	10	4,500	5·00	225·22	J. Cabassi ..	Lansdowne Polydymite (4995)
Wooroloo Vanity 2nd	A.I.S.		9-11-43	1-7-47	120	33	4,920	4·52	222·72	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Glanavon Goldilocks 7th	do.		17-9-43	4-9-47	210	16	5,580	3·91	218·40	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Walgett Proud Wyandotte	Jersey		1-5-43	12-4-47	273	11	4,638	4·68	217·41	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Wokanup Daphne 2nd	A.I.S.		10-10-43	2-8-47	210	10	6,390	3·31	211·59	Burkitt & Brown	Parkview Commodore (306)
Narrogin Flo	do		6-4-43	11-3-47	210	14	5,805	3·37	195·84	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Radford Park Pansy	Jersey		22-5-44	13-8-47	240	3	4,125	4·73	195·15	Radford Park Co.	Grassvale Golden Lad (19599)
Valliere Dove 2nd	A.I.S.		20-1-44	20-8-47	150	25	5,595	3·47	194·34	J. H. Bensted & Co.	Wooroloo Noble 4th (6411)
Muresk Gwenda ...	Guernsey	13932	3-5-43	11-1-47	180	16	4,275	4·54	194·13	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Mokine Twylish Lass 10th	Jersey		1-3-44	4-12-47	120	28·5	3,675	4·80	176·67	T. H. Wilding	Mokine Royal Dick (21018)
Glanavon Pink Pearl 6th	A.I.S.		2-10-43	7-9-47	210	7·5	4,995	3·37	168·60	Burkitt & Brown	Blacklands Jean's Supreme (1871)
Tipperary Dove 2nd	do		29-3-43	8-2-47	180	5	3,900	4·03	157·53	W. G. Burges	Tipperary Ace (6336)
Plenarbor Tottie	do.		26-5-44	11-2-48	150	24	3,570	3·72	132·84	Mrs. V. Alexander	Glanavon Genius (3957)
Tipperary Dove 23rd	do.		7-4-43	1-1-47	90	30	3,120	4·00	124·86	W. G. Burges	Tipperary Ace (6366)
Plenarbor Hettie	do.		6-1-43	7-11-46	210	5	2,730	3·53	96·60	Mrs. V. Alexander	Glanavon Genius (3957)
Glanavon Red Wing	do.		1-4-44	21-2-48	90	18	2,250	3·70	83·43	D. Bevan & Sons	Newstead Triumph (3420)
Plenarbor Daisy 2nd	do.		5-3-44	26-11-47	90	15·5	2,025	4·03	81·63	Mrs. V. Alexander	Glanavon Genius (3957)
Koojan Ace's Juliette	Guernsey	13501	29-5-44	15-12-47	60	20	1,485	5·06	75·18	R. J. Giles	Homestead Ace (1631) (Imp.)
Plenarbor Pearl	A.I.S.		6-5-44	8-1-48	90	18·5	2,025	2·24	65·79	Mrs. V. Alexander	Glanavon Chief (6864)
Denmark Ace's Briarette	Guernsey	12670	9-8-43	23-5-47	60	13·5	1,125	5·48	61·74	Denmark Research Station	Denmark Ace (5738)

COWS 4 YEARS AND UNDER 4½ YEARS—STANDARD 310 LB. BUTTERFAT.

Grassvale Golden Cream 26th	Jersey	98525	3-8-43	3-9-47	273	17·5	8,677	6·18	536·92	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Travalgan Starbright 23rd	do	100462	27-6-43	2-7-47	273	20	8,310	6·21	515·76	J. C. Bushell	Orphanage Douglas (18919)
Muresk Anna	Guernsey	11058	28-9-42	13-3-47	273	29·5	10,663	4·60	491·12	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Eungella Faline	Jersey	98285	4-5-43	24-5-47	273	15	8,475	5·54	470·02	D. G. Spark .	Travalgan Starbright King (18129)
Capel Dove 2nd	A.I.S.		18-5-43	10-7-47	273	7·5	10,717	4·27	458·47	B. W. Prowse	Capel Lottie's Reward (3782)
Muresk Delicia's Pride	Guernsey	13923	11-6-43	15-8-47	273	18	9,474	4·81	455·73	Muresk Agricultural College	Koojan Ace's Warspite (5943)
Mokine Twylish Lass 9th	Jersey		31-3-43	12-9-47	273	9	7,842	5·53	434·13	Davies & Sons	Mokine Brigadier (18799)
Tipperary Dove 25th	A.I.S.	40635	6-5-43	7-8-47	273	21	11,553	3·71	429·74	W. G. Burges	Tipperary Ace (6336)
Glanavon Doris 14th	do		21-5-42	20-10-46	273	19	9,942	4·29	427·24	D. Bevan & Sons	Newstead Triumph (3420)
Radyr Park Dorothy 22nd	Jersey		7-6-43	27-7-47	240	10	6,720	6·27	421·35	F. Campbell ...	Navua September Lad (14023)
Juadine Fairy	do	93213	12-6-43	23-6-47	240	14	6,360	6·50	413·91	K. V. Gray	Juadine Northwood Beau (19670)
Denmark Reflection's Dame	Guernsey	12693	15-2-43	4-7-47	273	14·5	8,383	4·81	403·81	Denmark Research Station	Koojan Ideal's Reflection (4974)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 4 YEARS AND UNDER 4½ YEARS—STANDARD 310 LB. BUTTERFAT—*continued.*											
Walgett Royal Joy	Jersey		2-5-43	29-6-47	273	11	6,873	5·57	383·19	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Mayvale Golden Diana	Guernsey	13663	6-9-42	28-10-46	273	16	6,738	5·30	357·72	R. J. Giles	Koojan Ideal's Discoverer (4968)
Trelawney Belle	Jersey		12-5-43	25-5-47	273	16	5,508	6·40	352·64	F. Campbell	Greenmount Golden Patch (19603)
Mokine Empire's Twylish 15th	do.	99412	1-4-43	2-7-47	273	13	5,964	5·78	345·05	Davies & Sons	Mokine Brigadier (18799)
Radyr Park September's Estrellita	do.		22-6-43	1-7-47	273	11	5,610	6·09	341·84	L. M. Temple	Navua September Lad (14023)
Walgett Delightful	do.		21-4-43	25-6-47	273	12	6,591	4·93	325·55	C. J. Cunningham	Selsey Wynadotte's Prince (18058)
Lansdowne Ideal's Pride	Guernsey	13533	9-1-43	6-2-47	273	24	5,952	5·43	323·47	J. R. Giles	Koojan Beau Ideal (4965)
					365	15	7,680	5·44	418·21		
Glanavon Doris 17th	A.I.S.		21-7-43	31-8-47	273	18	7,824	4·00	313·03	D. Bevan & Sons	Blackland's Jean's Supreme (1871)
Mokine Empire Lily 35th	Jersey	..	29-6-42	28-10-46	273	14	5,592	5·42	303·19	K. V. Gray	Selsey Hall Boy (15136)
Wooroloo Gail	A.I.S.	..	28-2-43	19-4-47	180	30	6,510	4·64	302·16	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Clovelly Melba	Guernsey	12613	21-6-43	10-7-47	273	8·5	6,190	4·69	290·80	J. Cabassi	Lansdowne Polydymite (4995)
Carbanup Fragrance	A.I.S.		10-2-43	25-3-47	273	15	7,590	3·76	285·55	D. H. Bell	Newstead Royal Sun (7252)
Claremont Biddy 71st	do.	..	18-11-42	12-2-47	273	26	7,473	3·81	285·43	W. K. Barnes	Westby Monarch (5404)
Mereworth Oxford Gay	Jersey	....	12-5-43	31-8-47	273	5	5,550	5·06	281·18	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Walgett Handsome Girl 31st	do.	..	20-4-43	10-5-47	273	8	6,114	4·59	281·07	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Mereworth Oxford Montrose	do.	..	4-5-43	17-7-47	273	4	5,952	4·54	270·72	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Travalgan Lady Eion 17th	do.	110454	29-5-43	20-8-47	210	8·5	4,455	6·05	269·76	Davies & Sons	Orphanage Douglas (18919)
Carbanup Floss	A.I.S.	....	23-4-43	16-5-47	180	40	7,770	3·34	260·19	D. H. Bell	Newstead Royal Sun (7252)
Juadine Jewel 4th	Jersey		4-10-43	1-11-47	150	12	4,170	6·22	259·47	F. Campbell	Juadine Northwood Beau (19670)
Rutherwood Daffodil	Guernsey	14484	18-5-43	28-8-47	273	13	4,719	5·40	255·20	Misses E. & I. Rutherford	Rutherwood Robin Adair (5238)
Melbury Chance	A.I.S.	..	27-4-42	23-10-46	273	10	6,435	3·93	253·07	G. W. Marston	Claremont Mount Rufus (3803)
Mereworth Starbright's Audrey 6th	Jersey		7-4-43	15-8-47	273	5	5,355	4·64	248·57	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Carbanup Floxy	A.I.S.		19-2-43	10-4-47	240	18	7,110	3·38	240·99	D. H. Bell	Newstead Royal Sun (7252)
Carbanup Fuchsia	do.		16-2-43	17-6-47	150	35	6,960	3·39	236·22	D. H. Bell	Newstead Royal Sun (7252)
Tirano Katoomba 2nd	do.	47508	12-2-43	26-7-47	180	24·5	6,045	3·84	231·93	J. Bensted & Co.	Chittering Prince (3800)
Lenmoor's Roma	A.I.S.	45031	16-8-43	11-10-47	240	4	5,430	4·08	222·06	W. K. Barnes	Ferndale Radiant (5729)
Mereworth Starbright's Queen 5th	Jersey		9-5-43	5-8-47	273	2	4,821	4·58	220·88	B. Langridge	Grantham Oxford Standard (18571)
Tirano Allison	A.I.S.		26-5-43	6-7-47	210	15·5	6,015	3·64	219·24	J. Bensted & Co.	Chittering Prince (3800)
Mereworth Oxford Buttercup 2nd	Jersey		9-5-43	7-10-47	240	8	4,935	4·43	218·61	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Rutherwood Anne	Guernsey	14480	7-5-43	30-7-47	273	8	4,359	4·68	204·03	Misses E. & I. Rutherford	Rutherwood Robin Adair (5238)
Mayvale Discoverer's Bluebell 2nd	do.	13658	24-9-43	29-9-47	150	12·5	3,840	5·06	194·69	R. J. Giles	Koojan Ideal's Discoverer (4968)

Yokanup Carnation 4th	A.I.S.		10-2-43	10-8-47	180	16	5,520	3·51	193·92	Burkitt & Brown	Parkview Commodore (306)
Carbanup Freda	do.		8-7-43	18-9-47	90	54	5,190	3·11	161·64	D. H. Bell	Newstead Royal Sun (7252)
Glanavon Gwen 3rd	do.		29-6-43	1-12-47	120	10	2,985	5·14	153·54	Burkitt & Brown	Blacklands Monarch's Commander (1877)
Carydale Roberta	do.		13-3-43	12-5-47	180	16	4,590	3·33	153·27	M. H. Montgomery	Summerlea Robin Hood (5261)
Plenarbor Daphne	do.		19-6-43	30-9-47	210	8·5	4,110	3·60	148·23	V. Alexander	Glanavon Genius (3957)
Emerald Vale Handsome	do.		11-11-43	26-4-48	90	22·5	2,025	3·90	79·11	St. Joseph's Farm School	Scotch College Sir Nigel (8657)
Emerald Vale Melba	do.		13-2-44	26-3-48	90	15·5	1,755	2·97	52·23	St. Joseph's Farm School	Scotch College Sir Nigel (8657)
Plenarbor Toddles	do.		26-5-44	6-6-48	30	29·5	885	4·28	37·74	Mrs. V. Alexander	Glanavon Genius (3957)

COWS 4½ YEARS AND UNDER 5 YEARS—STANDARD 330 LB. BUTTERFAT.

Grassvale Silvermine 2nd	Jersey		8-9-42	25-6-47	273	20	9,990	5·31	530·70	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Walgett Handsome Girl 29th	do.		24-6-42	22-4-47	273	21	7,263	6·91	502·05	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Travalgan Lady Eion 16th	do.	100454	3-9-42	3-7-47	273	20	8,280	5·74	475·53	W. H. & T. F. Robinson	Glen Iris Golden Oxford (12694)
Denmark Bonnie Princess	Guernsey	12676	28-11-42	4-7-47	273	22	9,186	4·87	447·58	Denmark Research Station	Koojan Ideal's Reflection (4974)
Eungella Miss Muffet	Jersey	92031	5-5-42	5-5-47	273	18	7,644	5·50	420·80	D. G. Spark	Travalgan Star Bright King (18129)
Clovelly Lily	Guernsey	10244	25-8-42	18-7-47	273	13	7,479	5·50	411·57	J. Cabassi	Lansdowne Polydymite (4995)
Denmark Lady Diana 2nd	do.	12687	29-10-42	22-9-47	273	13	6,399	6·38	408·87	Denmark Research Station	Denmark Dawn's Appollo (4785)
Clovelly Cherry	do.	10239	24-8-42	17-7-47	273	10	7,875	5·14	405·40	J. Cabassi	Koojan Monogram (4174)
Colmyn Empress	Jersey	97884	9-9-42	11-8-47	273	10·5	6,541	5·89	385·91	C. H. Ironmonger	Greenmount Cream Lad (18577)
Radyr Park Dorothy 20th	do.	99940	17-6-42	21-4-47	273	18	7,464	5·07	378·50	L. M. Temple	Navua September Lad (14023)
Warralyn Marie 10th	do.	89542	4-6-42	29-5-47	273	17	6,501	5·70	371·14	M. B. Stott	Juadine Sparkle's Wonder (18659)
Glanavon Fussy 2nd	A.I.S.		20-9-42	18-7-47	273	12	9,396	3·93	369·35	D. Bevan & Sons	Blacklands Monarch's Commander (1877)
Kapara Velveteen	Jersey	93311	23-5-42	16-5-47	273	8	8,074	4·51	364·78	D. Bradford	Congelin Mandarin (14542)
Greenmount Dewdrop 3rd	do.		11-8-42	23-2-47	273	20	5,670	6·37	361·26	K. V. Gray	Greenmount Silver Lord (17546)
Lansdowne Bonnie Elizabeth	Guernsey	10706	1-6-42	29-5-47	273	19	7,092	5·09	361·08	J. R. Giles	Koojan Beau Ideal (4965)
Kapara Sparkle's Lassie 2nd	Jersey	98818	14-10-42	2-5-47	273	25	7,860	4·41	346·75	W. L. Bradford	Congelin Jolly Eminent 3rd (18425)
Walgett Handsome Girl 30th	do.		9-7-42	16-4-47	273	17·5	6,337	5·45	345·62	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Kapara Duchess	do.	98815	14-9-42	9-5-47	273	7	5,991	5·50	329·78	D. Bradford	Congein Mandarin (14542)
Glanavon Goldilocks 5th	A.I.S.		10-10-42	5-6-47	273	5	7,605	4·14	315·26	D. Bevan & Sons	Glanavon Federal (6869)
Lenmoor's Queen 4th	do.		9-7-42	19-6-47	210	12	6,345	4·51	286·50	G. W. Marston	Ferndale Memento (3194)
Summerlea Swallow 18th	do.		31-7-42	19-7-47	240	13	6,435	4·38	281·14	M. H. Montgomery	Summerlea Tojo's Triumph (6243)
Narrogin Doreen	do.		13-8-42	20-3-47	273	17	8,601	3·24	278·94	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Walgett Handsome Girl 28th	Jersey		21-5-42	4-4-47	273	17	5,976	4·63	276·86	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Grassvale Lady Fowler 37th	do.	92720	21-8-42	29-4-47	180	26·5	5,580	4·81	268·56	R. G. Brazier	Mornmoot Northwood Beau (17798)
Campania Lulu	A.I.S.		1-5-42	12-4-47	273	6·5	6,544	3·67	240·39	K. Prowse	Longridge Triumph (5932)
Yokanup Ulery	do.		18-10-42	19-7-47	273	7	6,591	3·34	220·32	Burkitt & Brown	Parkview Commodore (306)
Grassvale Buttercup 11th	Jersey	92714	5-7-42	5-5-47	180	20	3,975	5·37	213·69	R. G. Brazier	Mornmoot Northwood Beau (17798)
Narrogin Flossette	A.I.S.		18-8-42	14-8-47	273	6·5	5,959	3·46	206·55	Christian Brothers' Farm School	Tipperary Amy's Mascot (6338)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 4½ YEARS AND UNDER 5 YEARS—STANDARD 330 LB. BUTTERFAT—*continued.*											
Burlington Beauty ..	Jersey	97716	25–10–42	3–8–47	210	6·5	3,645	4·52	164·97	B. C. H. Hack	Lawrenny Johnnie (16670)
Wondella Noble Lass ..	do.		26–12–42	6–12–47	180	12	2,880	5·10	147·15	B. C. H. Hack ..	Congelin Jolly Eminent 2nd (18424)
Tirano Sally ..	A.I.S.	..	18–10–42	19–5–47	120	21	3,135	3·69	115·80	J. H. Bensted & Co. ..	Chittering Prince (3880)
Glanavon Pansy 6th ...	do.	..	24–4–42	24–3–47	120	9	2,430	3·96	96·27	D. Bevan & Sons	Newstead Triumph (3420)
Grantham Silvermine 3rd ..	Jersey	..	9–8–42	28–6–47	30	27·5	825	3·60	29·73	B. Langridge ...	Rosecliffe Marchalong (15094)
COWS 5 YEARS OLD AND OVER—STANDARD 350 LB. BUTTERFAT.											
Camden Ariadne	Jersey	85538	10–8–40	31–5–47	273	38	10,869	6·94	754·37	C. E. Kruger	Greenmount Golden Sultan (14688)
					365	24	12,975	7·00	908·86		
Congelin Iolanthe 8th	do.	80828	22–4–40	20–5–47	273	35	13,215	5·57	737·19	D. Bradford	Rosecliffe Marchalong (15094)
Mokine Beauty	do.	94437	20–9–41	23–6–47	273	35	11,625	5·54	644·50	T. H. Wilding	Erlwin Royal Volunteer (16491)
Juadine Sally	do.	98755	5–10–41	26–5–47	273	24	10,842	5·84	633·22	M. B Stott	Austral Park Wonderful Standard (12423)
Congelin Rosemarie 6th	do.	80830	14–4–40	17–4–47	273	28	9,954	6·34	631·96	D. Bradford	Rosecliffe Marchalong (15094)
Greenmount Golden Ray ...	do.	8663	16–6–41	11–2–47	273	30	9,660	6·51	629·69	J. C. Bushell	Belgonia Peggy 6th Aim (17263)
Koojan Golden Jewel	Guernsey	8805	12–3–40	25–12–46	273	24	10,182	5·65	575·59	A. W. Padbury ..	Koojan Beau Ideal (4965)
Valliere Kate ..	A.I.S.	40817	28–6–40	30–3–47	273	23	12,414	4·58	568·58	M. L. House	Alpha Vale Patrico (3649)
Mokine Daisy 2nd	Jersey	77788	4–5–38	12–9–37	273	20	10,200	5·48	558·96	T. H. Wilding ..	Selsey Hall Boy (15136)
Grassvale Lady Fowler 33rd	do.	92716	7–7–41	2–6–47	273	15	9,885	5·46	539·71	R. H. Rose	Mornmoot Northwood Beau (17798)
Wooroloo Netta 2nd	A.I.S.	33996	6–10–39	29–1–47	273	29	12,147	4·38	532·60	Wooroloo Sanatorium Farm	Glanavon Genius (3957)
Muresk Daltana	Guernsey	11060	22–3–41	22–4–47	273	28	10,584	4·95	524·15	Muresk Agricultural College	Denmark Damon (2519)
Grassvale Magnolia 4th	Jersey	86645	23–11–41	2–7–47	273	12	9,741	5·20	507·05	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Muresk Lady Boniface	Guernsey	11067	23–4–41	25–7–47	273	23	9429	5·35	505·13	Muresk Agricultural College	Denmark Damon (2519)
Denmark Golden Valencia 2nd	do.	8535	15–9–39	6–5–47	273	23	9079	5·53	502·71	Denmark Res. Stn.	Koojan Ace's Goldseeker (3431)
Valliere Star	A.I.S.	33720	28–3–39	8–3–47	273	18	11,289	4·42	499·10	C. P House	Alpha Vale Patrico (3649)
Koojan Ideal's Jacqueline	Guernsey	10695	14–3–41	14–3–47	273	27	9,171	5·38	494·07	A. W. Padbury ..	Glenburnie Ideal (Imp.) (2548)
Lansdowne Jocelyn	do.	10720	15–7–40	30–11–46	273	27	9,651	5·06	489·25	A. W. Padbury	Koojan Beau Ideal (4965)
Denmark Ace's Rose ...	do.	10284	29–11–41	11–5–47	273	24	9,237	5·22	482·94	Denmark Res. Stn.	Homestead Ace (Imp.) (1631)
Grassvale Lady Fowler 31st	Jersey	81634	17–8–40	23–8–47	273	22·5	9,532	4·85	462·85	R. H. Rose & Son	Grassvale Gold Boy (14684)
Walgett Handsome Girl 13th	do.	79448	2–5–38	11–5–47	273	19	9,957	4·63	461·17	C. J. Cunningham	Sabina Vale Betty's Beau (10018)
Glanavon Dahlia 7th	A.I.S	30581	23–3–38	10–10–46	240	32	10,530	4·35	458·16	D. Bevan & Sons ...	Glanavon Neptune (3959)
Colmyn Golden Lustre	Jersey	80800	5–9–40	19–8–47	273	12	8,826	5·17	456·67	C. H. Ironmonger ...	Clarendon Eyre Golden Oxford (13606)
Greenmount Marion	do.	86666	7–5–41	16–3–47	273	29	9,402	4·76	448·05	K. V. Gray	Belgonia Peggy 6th's Aim (17263)
Grassvale Lady Fowler 21st	do.	66784	3–11–35	3–9–47	273	20	8,475	5·20	441·15	R H. Rose & Son	Melrose Lost Key (7974)

Colmyn Golden Margot	**Jersey**	**80801**	**29-7-40**	**23-3-47**	**273**	**29**	**8,557**	**5·05**	**432·24**	**C. H. Ironmonger**	**Clarendon Eyre Golden Oxford (13606)**
Valliere Countess	A.I.S.	40798	5-7-41	7-4-47	273	12·5	10,957	3·94	432·07	M. L. House	Wooroloo Searchlight (6415)
Warralyn Marie 5th	Jersey	84475	14-8-39	6-5-47	273	22	7,491	5·73	429·60	M. B. Stott	Juadine Hall Boy (16615)
Denmark Velveteen	Guernsey	8541	24-7-39	28-10-46	273	14·5	7,798	5·50	429·60	Denmark Research Station	Koojan Ace's Goldseeker (3431)
Denmark Mary's Bonnie	do.	10295	22-7-41	24-2-47	273	24	7,572	5·60	424·06	Denmark Research Station	Denmark Lady's Goldseeker (4799)
Lenmoor's Queen 2nd	A.I.S.	37904	24-7-40	15-6-47	273	8	11,539	3·64	419·92	G. W. Marston	Lenmoor's Gem (4977)
Walgett Joy's Gift ...	Jersey		6-4-42	22-4-47	273	25	8,880	4·71	418·80	C. J. Cunningham ...	Selsey Wyandotte's Prince (18058)
Walgett Handsome Girl 20th	do.	84441	21-4-39	27-5-47	273	12	7,341	5·66	416·07	C. J. Cunningham .	Sabina Vale Betty's Beau (10018)
Capel Fairy 3rd	A.I.S.	42453	30-4-42	3-6-47	273	16 5	10,924	3 79	414·18	K. Prowse	Capel Lottie's Reward (3782)
Grassvale Buttercup 7th	Jersey	81622	9-9-39	27-7-47	273	13·5	7,465	5·50	410·99	R. H. Rose & Son	Grassvale Gold Boy (14684)
Glanavon Pansy 5th ...	A.I.S.	36568	13-6-39	6-1-47	273	23	10,179	4·03	410·84	D. Bevan & Sons ...	Glanavon Franklyn (4829)
Radyr Park Dorothy 10th	Jersey	83556	4-7-39	6-9-47	273	18·5	9,130	4·49	410·00	L. M. Temple ..	Navua Coronation Star (14929)
Denmark Bonnie Mary ..	Guernsey	6958	30-9-37	4-7-47	273	18	7,974	5 11	407 98	Denmark Research Station	Denmark Illustrius (3320)
Tipperary Beauty 7th	A.I.S.	33565	29-7-39	2-6-47	273	24	10,062	4 03	406·30	W. G. Burges	Wooroloo Melba's Triumph (4491)
Radyr Park Dorothy 19th	Jersey	95267	16-3-42	17-9-47	273	18	8,739	4 62	404 11	L. M. Temple ...	Navua Coronation Star (14929)
Grassvale Nora's Maid . .	do.	98527	9-9-41	11-8-47	273	15·5	8,656	4·61	399 62	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Denmark Diana . .	Guernsey	6963	28-6-36	1-1-47	273	23·5	7,360	5·42	399·53	Denmark Research Station	Denmark Damon (2519)
Juadine Peggy	Jersey	93219	16-9-41	17-12-47	273	25	7,395	5·34	395 00	J. C. Bushell	Austral Park Wonderful Standard (12423)
Tipparary Lady . .	A.I.S.	28225	28-7-37	9-5-47	273	17	10,761	3·65	393·52	K. Prowse	Newstead Royal Light (3416)
Walgett Melanie .	Jersey		10-4-41	1-6-47	273	13	6,789	5·79	393 25	C. J. Cunningham .	Selsey Wyandotte's Prince (18058)
Kapara Happy Days 2nd	do.	93309	3-12-41	18-4-47	273	17	7,011	5·59	392 41	D. Bradford	Grantham Easter Oxford (14677)
Walgett Lady Wynadotte	do.		29-4-42	14-6-47	273	16·5	8,044	4·81	386·99	C. J. Cunningham .	Selsey Wyandotte's Prince (18058)
Walgett Handsome Girl 25th	do.		7-4-42	1-6-47	273	14·5	7,528	5·12	386·12	C. J. Cunningham .	Selsey Wyandotte's Prince (18058)
Glanavon Golden Girl 4th	A.I.S.	36554	10-11-39	27-11-46	273	24	11,157	3·45	384·95	D. Bevan & Sons ...	Blacklands Jean's Supreme (1871)
Juadine Julienne .	Jersey	87020	2-3-40	19-7-47	273	11·5	7,789	4·92	383·14	Mrs. M. A. Watson	Austral Park Wonderful Standard (12423)
Grassvale Lady Fowler 36th	do.		28-5-42	30-6-47	273	16	7,548	5·07	383·07	R. H. Rose & Son ...	Grassvale Gold Boy (14684)
Mokine Empire Lily 37th	do.		25-8-42	5-9-47	210	12·5	6,600	5·79	382·77	Davies & Sons ...	Mokine Brigadier (18799)
Walgett Handsome Girl 16th	do.	84439	29-3-39	5-6-47	273	16·5	7,339	5 20	381·75	C. J. Cunningham	Walgett Masterman (15271)
Clovelly Golden Pride	Guernsey	8501	26-10-38	5-6-47	273	13 5	7,900	4·82	380·93	J. Cabassi	Drakesbrook Golden Gift (2651)
Valencia Vale Chloe	Jersey		8-6-40	31-7-47	273	9·5	6,178	6 13	379·24	K. V. Gray . ..	Grassvale Fowler's Twylish (12733)
Denmark Dame 2nd .	Guernsey	10289	6-11-41	14-3-47	273	21	7,248	5 23	379·16	Denmark Research Station	Denmark Lady's Goldseeker (4799)
Colmyn Golden Carnation	Jersey	80795	30-7-40	4-8-47	273	12·5	7,012	5·34	374·45	C. H. Ironmonger ..	Clarendon Eyre Golden Oxford (13606)
Rutherwood Rosebud	Guernsey	7827	15-7-37	29-4-47	273	23	7,809	4·70	367·46	Misses E. & I. Rutherford	Demark Robin Hood (3322)
Lenmoor's Queen 3rd	A.I.S.		12-11-41	5-8-47	273	19	8,937	4·08	365·28	G. W Marston ...	Ferndale Memento (3194)
Melbury's Spring	do.		18-7-39	9-5-47	273	23 5	9,805	3 70	362·89	K. Prowse . . .	Claremont Mount Rufus (3803)
Walgett Joyful	Jersey	79450	29-8-38	2-4-47	273	23	6,684	5·41	362·26	C. J. Cunningham ...	Sabina Vale Betty's Beau (10018)
Grassvale Topsy . ..	do.	86647	11-8-41	30-4-47	273	15 5	7,561	4·77	361 19	K. V. Gray ..	Mornmoot Northwood Beau (17798)
Tirano Alice . .	A.I.S.	22916	31-5-36	16-3-47	273	25 5	9,016	4 00	360 95	J. H. Bensted & Co.	Bryn Y Mor Charmer (266)
Lenmoor's Bluebell	do.	37898	12-4-42	10-9-47	240	5	8,925	4 03	359·67	G. W. Marston	Ferndale Memento (3194)
Grantham Easter Rye 5th .	Jersey	66773	8-7-37	14-5-47	273	15	6,150	5 84	359 46	B. Langridge	Greenmount Black Prince (6511)
Mereworth Rye Buttercup	do.	67930	29-6-38	11-9-47	273	12	7,101	5·03	357·54	B. Langridge	Mereworth Rye Duke (13953)
Walgett Handsome Girl 19th	do.	84440	6-4-39	5-4-47	273	18	6,324	5·64	357·30	C. J. Cunningham	Sabina Vale Betty's Beau (10018)

TABLE 9—HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 5 YEARS OLD AND OVER—STANDARD 350 LB. BUTTERFAT—*continued.*											
Clovelly Golden Flirt	Guernsey	8500	1-6-39	27-6-47	240	11	7,050	5·06	356·61	J. Cabassi	Koojan Monogram (4174)
Colmyn Golden Patsy	Jersey	80804	27-5-39	6-6-47	210	23	7,275	4·85	353·19	G. Layman	Clarendon Eyre Golden Oxford (13606)
Denmark Golden Maria	Guernsey	8529	27-6-40	22-6-47	273	10	6,510	5·40	351·84	Denmark Research Station	Denmark Damauric (400)
Claremont Cherry 9th	A.I.S.	15955	25-11-34	25-4-47	273	24	7,282	4·77	347·90	Narrogin School of Agriculture	Tipperary Virginia Re-echo (970)
Tipperary Peggy 2nd	do	40550	10-7-41	18-2-47	273	21	9,393	3·68	346·24	W. G. Burges ..	Tipperary Ace (6336)
Walgett Jocelyn	Jersey	89500	13-8-40	16-4-47	273	15	6,465	5·33	344·62	C. J. Cunningham	Selsey Wyandotte's Prince (18058)
Clovelly Crystal	Guernsey	10240	31-8-41	13-6-47	240	16	7,590	4·52	343·20	J. Cabassi .	Koojan Monogram (4174)
Radyr Park Dorothy 4th	Jersey	63850	5-10-35	6-8-47	273	17	6,591	5·20	342·95	L. M. Temple .	Greenmount Graceful Lad (7292)
Radyr Park Coronation Belle	do.	73600	5-7-47	5-6-47	273	10	6,780	5·03	341·32	L. M. Temple .	Navua Coronation Star (14929)
Glanavon Doris 13th	A.I.S.	33541	25-2-41	10-4-47	273	16	8,028	4·17	334·81	D. Bevan & Sons ..	Blacklands Monarch's Commander (1877)
Rutherwood Robin's Daisy	Guernsey	9329	11-9-38	2-4-47	273	22	6,381	5·20	331·94	Misses E. & I. Rutherford	Denmark Robin Hood (3322)
Coogely Johnquil	do.	6945	1-11-37	23-12-46	273	10	5,802	5·65	327·94	Denmark Research Station	Coogely Judy's Goldmine (2621)
Denmark Angeline	do.	6956	4-7-37	3-1-47	273	12	5,991	5·46	327·59	Denmark Research Station	Koojan Golden Prosper (2283)
Mereworth Starbright's Vanilla 4th	Jersey	94249	7-5-41	15-5-47	273	19	6,582	4·93	324·50	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Wooroloo Wendy 3rd	A.I.S.	28662	27-9-38	4-1-47	273	9	7,587	4·25	323·10	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Carbanup Baroness	do	29616	15-4-39	12-6-47	180	42	9,390	3·41	320·67	D. H. Bell . .	Glanavon Maestro (4833)
Walgett Heirloom	Jersey	89499	20-4-40	4-3-47	273	23	6,129	5·20	319·23	C. J. Cunningham .	Sabina Vale Betty's Beau (10018)
Rosella Zinnia	Guernsey	11430	11-8-40	31-3-47	273	11	6,648	4·76	316·96	Darnell Brothers	Muresk Paul (4356)
Denmark Golden Dawn	do.	4118	9-1-33	14-1-47	273	26	5,853	5·40	316·60	Denmark Research Station	Koojan Golden Prosper (2283)
Clovelly Primrose	do.	10245	30-6-42	23-8-47	240	13	6,750	4·62	312·03	J. Cabassi .	Koojan Monogram (4174)
Eungella Coquette	Jersey	81271	24-5-40	11-5-47	273	13	6,234	4·93	307·77	D. G. Spark .. .	Greenmount Golden Sovereign (14687)
Narrogin Donna	A.I.S.	32144	27-10-39	10-7-47	240	14	7,890	3·54	306·42	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)
Radyr Park Coronation's Estrellita	Jersey	83555	27-7-39	8-6-47	273	11	5,688	5·31	302·30	L. M. Temple .	Navua Coronation Star (14929)
Plenarbor Flora ..	A.I.S.	27198	19-7-38	25-4-47	240	14	9,270	3·25	302·10	K. Prowse	Tipperary Empress' Monarch (4436)
Eungella Bonetta	Jersey	92029	17-5-41	18-6-47	240	7	6,180	4·82	297·78	D. G. Spark . .	Travalgan Starbright King (18129)
Woodendale Ragtime's Violet	do	69775	14-6-36	27-6-47	273	5	5,550	5·34	296·65	Radford Park Co.	Spring Park Prince Ragtime (5942)
Koojan Golden Ripple	Guernsey	7248	26-3-38	7-8-47	273	15	5,835	5·05	295·03	Denmark Research Station	Homestead Ace (Imp.) (1631)

Mereworth Starbright's Belvedere 6th	Jersey	87805	19-4-39	14-9-47	273	10	6,240	4·70	293·31	B. Langridge	Walgett Campanile's Chief (16167)
Carbanup Beatrice	A.I.S.	29617	13-3-39	22-6-47	150	44	8,205	3·53	290 10	D. H. Bell	Glanavon Maestro (4833)
Radyr Park Dorothy 5th	Jersey	68752	18-7-36	21-8-47	240	11	5,130	5 56	285·66	L. M. Temple	Greenmount Graceful Lad (7292)
Walgett Easter Lily	do	69572	20-4-37	31-3-47	273	20·5	6,221	4 58	285 22	C. J Cunningham	Walgett Beau's Masterpiece (13349)
Narrogin Alice	A.I.S		14-4-42	15-8-47	273	15 5	7,566	3 76	284 54	Christian Bros. Farm School	Westby Masterpiece (5403)
Clovelly Margaret	Guernsey	6929	20-11-37	12-6-47	240	11	5,915	4 87	284 34	J. Cabassi	Nornabank Brian (3640)
Radyr Park June 2nd	Jersey	88645	16-5-41	23-6-47	273	9	5,712	4·95	282·97	L. M. Temple	Navua Coronation Star (14929)
Walgett Golden Duchess	do.	79446	21-5-38	12-4-47	273	13·5	5,980	4·72	282·68	C. J. Cunningham	Sabina Vale Betty's Beau (10018)
Rutherwood Dinah	Guernsey	9324	3-11-39	15-3-47	278	20	6,150	4·59	282·40	Misses E. & I. Rutherford	Denmark Robin Hood (3322)
Yokanup Pansy	A.I.S.		16-1-42	15-6-47	273	11	7,333	3 81	279·39	Burkitt & Brown	Parkview Commodore (306)
Mereworth Oxford Princess 2nd	Jersey	94245	24-2-41	11-9-47	273	9·5	5,938	4·70	279·27	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Walgett Handsome Girl 12th	do.	79447	24-4-38	22-4-47	273	14 5	6,658	4·17	277 77	C. J. Cunningham	Sabina Vale Betty's Beau (10018)
Wooroloo Gladys 2nd	A.I.S.		3-2-42	11-2-47	240	14	6,270	4·40	276 18	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Wooroloo Wynette	do.	41212	2-4-42	5-6-47	150	33	6,540	4·17	273·06	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Glanavon Aster	do.	30575	18-1-38	25-3-47	273	16	6,843	3·95	270·44	D. H. Bell	Glanavon Nimrod (437)
Noorong Belladonna	Jersey		1-3-40	7-11-46	273	13 5	4,750	5·67	269·89	K. V. Gray	Clarendon Eyre Eminent Geisha
Radyr Park Dorothy 14th	do.	95266	22-4-41	26-1-47	273	11	5,778	4 64	268 30	L. M. Temple	Navua September Lad (14023)
Narrogin Colleen	A.I.S.	38665	22-8-41	11-3-47	273	19 5	7,198	3·72	267·79	Narrogin School of Agriculture	Westby Masterpiece (5403)
Carydale Golden Gem	Jersey	91110	15-6-41	22-8-47	150	25	5,265	5 08	267·45	G. Layman	Clarendon Eyre Golden Oxford (13606)
Radford Park Poppy Queen	do.	95268	9-9-40	7-4-47	273	9	5,322	5 01	267·12	Radford Park Co.	Mokine Dunce (11896)
Norinya Nannette	do		9-6-39	28-3-47	273	21 5	5.359	4 97	266 55	Mrs. A. G. Eckersley	Austral Park Wonderful Standard (12423)
Eungella Bo-Peep	do.	71246	27-12-37	25-4-47	273	11	6,103	4 36	266·24	D. G. Spark	Greenmount Golden Sovereign (14687)
Clovelly Dainty	Guernsey	10241	5-8-41	11-9-47	240	5 5	5,730	4 62	264 81	J. Cabassi	Koojan Monogram (4174)
Lenmoor's Biddy	A.I.S		22-3-42	15-6-47	210	11	6,795	3 89	264·54	G. W. Marston	Ferndale Radiant (5729)
Valliere Milkmaid	do	40824	15-4-40	6-4-47	273	13	6,909	3·81	263·62	W. K. Barnes	Alpha Vale Patrico (3649)
Glanavon Echo 2nd	do.	36545	17-10-40	29-6-47	210	18	6,380	4 09	261·45	D. Bevan & Sons	Glanavon Gold's Final (5742)
Rosella Jeanette	Guernsey	14397	2-4-42	6-6-47	240	6	4,395	5 94	261·27	Darnell Brothers	Muresk Commander (9599)
Hades Topsy Turvy	A I S		23-9-41	2-6-47	210	12	6,660	3 91	260 79	W. G Burges	Hades Monarch (5800)
Camden Pit-a-Pat 2nd	Jersey	91042	13-1-42	28-9-47	240	10	5,265	4 94	260·43	B. Langridge	Greenmount Golden Sultan (14688)
Lenmoor's Joan 3rd	A I S.	37900	20-7-42	26-7-47	273	5 5	6,271	4·12	258 79	G. W. Marston	Ferndale Memento (3194)
Tipperary Dove 18th	do	40638	8-8-41	3-2-47	210	19	6,570	3 92	258 69	W. G. Burges	Tipperary Ace (6336)
Camden Patsy	Jersey	85543	27-6-39	21-12-46	273	14 5	4,708	5 45	256 89	C. E. Kruger	Greenmount Golden Sultan (14688)
Noorong Dahlia	do		26-12-39	2-8-47	240	8	5,370	4 77	256 23	K. V. Gray	Clarendon Eyre Eminent's Geisha 4th (13597)
Radford Park Marigold	do	95259	10-8-41	25-4-47	273	7·5	4,552	5·58	254·12	Radford Park Co.	Mokine Dunce (11896)
Capel Gibson Girl	A I.S.		5-3-42	4-7-47	240	8 5	6,330	4·01	253·89	K. Prowse	Valliere Commodore (6360)
Radyr Park Dorothy 16th	Jersey	88643	4-6-41	6-3-47	273	3 5	4,735	5·29	250 88	L. M. Temple	Navua Coronation Star (14929)
Plenarbor Valli	A.I.S		15-2-42	3-5-47	240	4	7,410	3 38	250·83	Mrs. V. Alexander	Glanavon Genius (3957)
Narrogin Daisybell	do.	38668	10-10-40	11-3-47	273	10 5	6,571	3 81	250·79	Narrogin School of Agriculture	Westby Masterpiece (5403)
Rutherwood Jonquil	Guernsey	6263	18-5-36	17-6-47	273	11·5	4,714	5·26	247·97	Misses E. & I. Rutherford	Koojan Forty Winks (2738)

TABLE 9—HERDTESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk on Last Day of Test. lb.	Weight of Milk for Period. lb.	Average Test. %	Weight of Butter Fat for Period. lb.	Owner.	Sire.
COWS 5 YEARS OLD AND OVER—STANDARD 350 LB. BUTTERFAT.											
Carbanup Constance	A.I.S.	35384	25-2-40	25-3-47	273	11·5	7,264	3·40	247·09	D. H. Bell	Glanavon Maestro (4833)
Plenarbor Millie	do.	27200	5-8-38	8-5-47	180	25·5	7,665	3·20	245·52	K. Prowse	Tipperary Empress' Monarch (4436)
Carbanup Dahlia	do.	35386	22-3-41	16-2-47	273	6·5	5,743	4·13	237·38	D. H. Bell	Glanavon Maestro (4833)
Yanget Graceful 4th	do.		9-10-39	5-6-47	273	10	6,360	3·73	237·37	Mrs. V. Alexander	Leylands Defiance (2380)
Narrogin Mae	do.	45652	13-7-42	24-8-47	273	9	5,937	3·98	236·62	Christian Bros. Farm School	Tipperary Amy's Mascot (6338)
Carbanup Crocus	do.	35385	25-2-40	25-3-47	273	13	7,224	3·25	235·33	D. H. Bell	Glanavon Maestro (4833)
Glanavon Doris 12th	do.	36540	17-2-41	27-12-46	210	10	5,610	4·11	230·73	D. Bevan & Sons	Tipperary President (5335)
Wallatin Eighty Five	do.	40881	29-4-40	19-3-47	210	11	5.340	4·22	225·66	M. H. Montgomery	Summerlea Pioneer (6240)
Noorong Grace	Jersey	78124	8-10-33	19-12-47	180	23·5	4,740	4·74	225·09	C. E. Kruger	Grassvale Butter King (8209)
Plenarbor Curly	A.I.S.	46144	26-6-42	10-9-47	240	5·5	6,375	3·48	221·85	Mrs. V. Alexander	Glanavon Genius (3957)
Lenmoor's Gentle	do.		22-5-42	23-8-47	240	3	5,700	3·80	217·02	G. W. Marston	Wooroloo Union Jack (7662)
Travalgan Lady Eion 6th	Jersey	79293	19-8-39	17-6-47	120	31·5	4,065	5·31	216·09	R. G. Brazier	Glen Iris Golden Oxford (12694)
Yanget Baron's Grace	A.I.S.	41223	3-9-41	17-4-47	273	2·5	6,592	3·25	214·30	Mrs. V. Alexander	Yanget Baron (6416)
Rosella Sweetheart	Guernsey	11429	30-7-40	23-8-47	180	7	4,440	4·78	212·49	Darnell Brothers	Muresk Paul (4356)
Tirano Fancy	A.I.S.		17-4-41	19-9-47	180	14	5,400	3·84	207·81	M. H. Montgomery	Chittering Prince (3800)
Wongella Lady Lorraine	Jersey		31-3-41	24-12-47	180	17	3,795	5·40	205·20	B. C. H. Hack	Congelin Jolly Eminent 2nd (18424)
Narrogin Dolly	A.I.S.	38669	20-8-41	5-2-47	150	17	4,680	4·38	205·02	Narrogin School of Agriculture	Westby Masterpiece (5403)
Travalgan Lady Eion 8th	Jersey	84258	19-9-40	24-4-47	180	22	4,515	4·47	202·02	R. G. Brazier	Glen Iris Golden Oxford (12694)
Tirano Lorna	A.I.S.	47507	20-12-40	26-6-47	210	10·5	5,790	3·41	197·55	J. H. Bensted & Co.	Chittering Prince (3800)
Rutherwood Fairy	Guernsey	11447	28-11-41	7-8-47	273	7·5	3,712	5·06	188·07	Misses E. & I. Rutherford	Rutherwood Sailor (5240)
Mokine Empire's Lily 34th	Jersey	94438	12-12-41	20-8-47	240	6	2,985	6·06	181·17	Davies & Sons	Selsey Hall Boy (15136)
Glanavon Golden Girl 6th	A.I.S.	36555	17-9-41	13-5-47	150	15	4,560	3·96	180·92	D. Bevan & Sons	Newstead Triumph (3420)
Rutherwood Pixie	Guernsey	7826	13-3-38	24-6-47	150	23	3,555	5·07	180·45	Misses E. & I. Rutherford	Rutherwood Rose Chief (4454)
Grassvale Lady Fowler 44th	Jersey	92717	19-8-41	11-5-47	180	11·5	3,705	4·76	176·67	R. G. Brazier	Mornmoot Northwood Beau (17798)
Rutherford Robin's Rosa	Guernsey	9330	30-8-38	26-3-47	273	13·5	3,535	4·98	176·12	Misses E. & I. Rutherford	Denmark Robin Hood (3322)
Valliere Primrose	A.I.S.		19-5-40	29-4-47	180	16	4,260	4·03	171·69	W. K. Barnes	Alpha Vale Patrico (3649)
Walgett Handsome Girl 4th	Jersey	59901	5-4-35	3-4-47	150	24·5	3,375	5·02	169·47	C. J. Cunningham	Sabina Vale Betty's Beau (10018)
Clovelly Bobette	Guernsey	10238	12-7-41	11-9-47	90	41	3,810	4·44	169·29	J. Cabassi	Koojan Monogram (4174)
Narrogin Stella	A.I.S.	38676	19-4-40	17-3-47	210	7	4,800	3·46	166·50	Narrogin School of Agriculture	Westby Masterpiece (5403)
Grassvale Lady Fowler 35th	Jersey	92718	1-3-42	11-6-47	120	24	3,075	5·38	165·54	R. G. Brazier	Mornmoot Northwood Beau (17798)
Rosella Girlie	Guernsey	14394	15-2-42	30-8-47	180	7	3,285	4·92	161·70	Darnell Brothers	Muresk Commander (4344)
Carbanup Doris	A.I.S.	35389	3-8-41	2-8-47	90	49·5	4,830	3·17	153·11	D. H. Bell	Glanavon Maestro (4833)
Westby Laurel	A.I.S.	40986	7-2-40	17-5-47	210	8	3,930	3·51	138·18	Narrogin School of Agriculture	Westby Searchlight (3604)
Rosella Queenie	Guernsey	9316	20-9-39	6-7-47	210	6	2,610	5·02	131·07	Darnell Brothers	Muresk Paul (4356)

Congelin Sparkle 4th ..	Jersey	91297	15-3-41	30-3-47	90	37	3,030	4·11	124·62	D. Bradford	Congelin Washington (18426)
Rutherwood Maid Marion .	Guernsey	9328	11-1-39	24-5-47	210	12·5	2,850	4·26	121·47	Misses E. & I. Rutherford	Denmark Robin Hood (3322)
Plenarbor Sapphire . .	A.I.S.		5-3-42	20-5-47	120	16·5	3,135	3·86	121·02	Mrs. V. Alexander .	Glanavon Genius (3957)
Melrose Brenda . .	do.		10-7-39	21-11-47	180	3·5	3,435	3·49	120·18	Christian Bros. Farm School	Tipperary Defiance (5329)
Grassvale Northwood Nora	Jersey	86646	23-5-41	5-5-47	60	38·5	2,310	5·09	117·78	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Rosella Duchess 2nd ..	Guernsey	9310	7-5-39	10-9-47	150	8	2,310	4·84	111·99	Darnell Brothers	Muresk Paul (4356)
Yanget Baron's Grace .	A.I.S.	41223	3-9-41	19-2-48	120	29·5	3,105	3·32	103·14	Mrs. V. Alexander ...	Yanget Baron (6416)
Emerald Vale Countess .	do.		12-4-39	17-12-47	180	10·5	2,730	3·52	96·18	Christian Bros. Farm School	Glanavon Lancer (4832)
Plenarbor Valli .	do.		15-2-42	22-4-48	60	35·5	2,205	4·01	88·47	Mrs. V. Alexander	Glanavon Genius (3957)
Yanget Graceful 4th	do.		9-10-39	4-5-48	60	33·5	2,010	3·82	76·89	Mrs. V. Alexander ...	Leylands Defiance (2380)
Travalgan Starbright 14th	Jersey	89349	18-5-41	17-4-47	60	25·5	1,545	4·71	72·84	R. G. Brazier ..	Glen Iris Golden Oxford (12694)
Plenarbor Sapphire	A.I.S.		5-3-42	2-4-48	90	18	1,890	3·66	69·36	Mrs. V. Alexander ..	Glanavon Genius (3957)
Congelin Iolanthe 10th	Jersey	91295	25-3-41	14-5-47	30	46	1,380	4·63	63·96	D. Bradford . ..	Congelin Washington (18426)
Greenmount Dewdrop 3rd	do.		11-8-42	20-3-48	90	9	1,155	5·34	61·77	K. V. Gray . .	Greenmount Silver Lord (17546)
Claremont Duchess 2nd	A.I.S.	9920	17-10-33	16-4-47	60	35	1,950	2·89	56·40	Narrogin School of Agriculture	Tipperary Virginia's Re-echo (970)
Plenarbor Tulip	do.	29216	4-4-40	20-5-47	60	25·5	1,455	3·63	52·95	Mrs. V. Alexander	Alne Bank Tena's Gift (1766)
Kapara Sparkle 3rd	Jersey	77064	21-7-39	9-5-47	30	28	840	5·61	47·19	D. Bradford	Congelin Mandarin (14542)
Plenarbor Tip Toe ...	A.I.S.		29-5-43	11-6-48	30	29	870	3·62	35·53	Mrs. V. Alexander ..	Glanavon Genius (3957)
Tirano Daisy .	do.	33573	7-5-38	22-2-48	30	26	780	3·56	27·84	M. H. Montgomery .	Chittering Prince (3800)
Travalgan Lady Elon 4th	Jersey	74240	28-8-38	4-8-47	60	12	675	3·58	24·18	W. H. & T. F. Robinson	Glen Iris Golden Oxford (12694)
Walgett Handsome Girl 16th	do.	84439	29-3-39	21-3-48	30	17	510	4·30	21·93	C. J. Cunningham ..	Walgett Masterman (15271)

FERTILISERS.

The following fertilisers have been registered at the Department of Agriculture under the Fertiliser Act, 1928, for the year commencing 1st November, 1948 :—

Name of Fertiliser.	Reg No.	Brand.	By Whom Registered.	Nitrogen (N) as: Nitrate.	Nitrogen (N) as: Ammonia.	Nitrogen (N) as: Blood and Bone.	Nitrogen (N) as: Bone Dust.	Phosphoric Acid (P_2O_5) as: Water Sol.	Phosphoric Acid (P_2O_5) as: Citrate Sol.	Phosphoric Acid (P_2O_5) as: Acid Sol.	Phosphoric Acid (P_2O_5) as: Total.	Potash (K_2O) as: Sulphate.	Potash (K_2O) as: Muriate.	Cash Price per ton at Works (W) or on Rails Perth (P).
A.—MINERAL.														£ s. d.
1. NITROGENOUS.														
(a) Nitrogen as Nitrate.														
Nitrate of Soda	23	C.S.M.L.	Cuming Smith & Mt. Lyell	15.50										18 10 0 (W)
Sodium Nitrate	44	Fauldings	F. H. Faulding & Co., Ltd.	16.00										1 17 4 cwt.
Nitrate of Soda	62	Champion	R. Dundas Smith & Son	16 00										18 10 0 (P)
Nitrate of Soda	84	David Gray's	David Gray & Co. Pty. Ltd.	15 50	.							..		11d. per 2 lb. bag
(b) Nitrogen as Ammonia.														
Sulphate of Ammonia	1	I.C.I.A.N.Z.	Cuming Smith & Mt. Lyell		20 50									18 10 0 (W)
Sulphate of Ammonia	45	Fauldings	F. H. Faulding & Co., Ltd.		20 00									1 12 8 cwt.
Ammonium Nitrate	43	do.	do. do. do.		30 00									6 1 4 cwt.
Sulphate of Ammonia	59	Cresco	Cresco Fertiliser Co.		20 50									18 10 0 (W)
Sulphate of Ammonia	79	David Gray's	David Gray & Co. Pty. Ltd.		21 00								..	11d. per 2 lb. bag
Sulphate of Ammonia	89	Tubal	Ralite Products	.	20·50			..				.	.	
2. PHOSPHATIC.														
(a) Superphosphate.														
Superphosphate 22%	2	Mt. Lyell as ML in diamond	Cuming Smith & Mt Lyell					18.00	2 00	2.00	22.00		..	*6 11 0
Do. do.	9	C.S.M.L.	do. do. do.					18.00	2 00	2.00	22.00	..		*6 11 0
Do. do.	25	Sickle	do. do. do.					18.00	2.00	2 00	22.00			*6 11 0
Do. do.	49	Cresco	Cresco Fertiliser Co.					18.00	2.00	2.00	22.00	.	.	*6 11 0
Do. do.	82	David Gray's	David Gray & Co. Pty. Ltd.	.	.	.		18·00	2·00	2·00	22·00	....	...	1s. 3½d. per 7 lb. bag
Do. do.	86	Tubal	Ralite Products ...	.	.	...		18·00	2·00	2·00	22·00	...	....	
(b) Superphosphate and Minors.														
Superphosphate and Zinc	17	C.S.M.L.	Cuming Smith & Mt. Lyell					17 00	1 75	1.75	20.50	..	zinc 2.50	*7 14 4
Superphosphate and Zinc Sulphate	61	Cresco	Cresco Fertilisers, Ltd.					17.00	1.75	1.75	20.50	...	0.80	7 16 4
Superphosphate and Copper No. 1	18	C.S.M.L.	Cuming Smith & Mt. Lyell					17 00	1.75	1.75	20.50	copper 1.25	..	*10 8 11
Superphosphate and Copper Ore No. 1	19	do.	do. do. do.					15.00	1 50	1.50	18.00	1.60	...	*9 15 11
Superphosphate and Copper Ore No. 2	20	do.	do. do. do.					15.00	1.50	1.50	18.00	1.00	...	*8 10 11

Superphosphate and Copper Ore No. 1	31	Sickle	do. do. do.					15.00	1.50	1.50	18.00	1.60	...	*9 15 11
Superphosphate and Copper Ore No. 2	32	do.	do. do. do.					15.00	1.50	1.50	18.00	1.00	..	*8 10 11
Superphosphate and Copper Ore No. 3	47	do.	do. do. do.					16.00	1.50	1.50	19.00	1.00	...	*8 17 10
Superphosphate and Copper Ore No. 3	48	C.S.M.L.	do. do. do.					16.00	1.50	1.50	19.00	1.00		*8 17 10
Superphosphate and Copper Sulphate	50	Cresco	Cresco Fertilisers, Ltd.					17.00	1.75	1.75	20.50	1.25	....	*10 8 11
Superphosphate and Copper Ore No. 1	51	do.	do. do.					15.00	1 50	1.50	18.00	1.60	.	*9 15 11
Superphosphate and Copper Ore No. 2	52	do.	do. do.					15.00	1 50	1.50	18.00	1.00	manganese	*8 10 11
Superphosphate and Manganese	21	C.S.M.L.	Cuming Smith & Mt. Lyell					15 00	1 75	1.75	18.50		3.80	*10 16 6
Superphosphate and Manganese	33	Sickle	do. do do					15 00	1.75	1.75	18.50		3 80	*10 16 6
Superphosphate and Manganese	53	Cresco	Cresco Fertilisers, Ltd.					15 00	1.75	1 75	18 50		3.80	*10 16 6
Superphosphate and Copper Ore No. 3	77	do	do. do. do.					16·00	1·50	1·50	19 00		Copper 1·00	8 17 10 (W)
3. POTASSIC.												Potash (K_2O) as		
(a) *Potash as Sulphate*												Sulphate	Muriate	
Sulphate of Potash	8	Mt. Lyell as ML in diamond	Cuming Smith & Mt. Lyell									30.00		20 0 0 (W)
Do do	22	C S M.L.	do do. do.									30.00		20 0 0 (W)
Do. do.	34	Sickle	do do do.									30 00		20 0 0 (W)
Do do	69	Cresco	Cresco Fertilisers, Ltd									30.00		20 0 0 (W)
Do do	76	Chandler	The State (W.A.) Alunite Industry									30·00		
Do do	81	David Gray's	David Gray & Co. Pty Ltd									30·00		11½d. per 2 lb. bag.
Do do	88	Tubal	Ralite Products									30·00		
4. NITROGEN AND PHOSPHORIC ACID														
Potato Manure " C "	5	Mt Lyell as ML in diamond	Cuming Smith & Mt. Lyell		3 50			14.50	1 50	1 50	17.50			*9 18 4
Potato Manure " C "	12	C S M L.	do do do.		3 50			14 50	1.50	1 50	17 50			*9 18 4
Potato Manure " C "	28	Sickle	do. do do		3.50			14 50	1 50	1 50	17.50			*9 18 4
Potato Manure " C "	56	Cresco	Cresco Fertilisers, Ltd		3 50			14.50	1 50	1.50	17.50			*9 18 4
5. NITROGEN, PHOSPHORIC ACID AND POTASH														
Potato Manure " A "	3	Mt Lyell as ML in diamond	Cuming Smith & Mt Lyell		2 50			12.00	1 25	1.25	14.50	5.00		*11 17 2
Potato Manure " B "	4	do	do do. do.		3 50			11.00	1.25	1.25	13 50	5 00	.	*12 10 5
Potato Manure " E "	6	do	do do do.		3 50			8.50	1.00	1.00	10.50	8.00		*14 1 6
Potato Manure " A "	10	C S M L	do do do		2.50			12 00	1.25	1.25	14.50	5 00		*11 17 2
Potato Manure " B "	11	C.S.M L.	do. do. do		3 50			11.00	1.25	1.25	13.50	5.00		*12 10 5
Potato Manure " E "	13	C.S M.L.	do. do. do.		3 50			8.50	1.00	1.00	10.50	8.00	..	*14 1 6

FERTILISERS—*continued.*

Name of Fertiliser.	Reg. No.	Brand.	By Whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton at Works (W) or on Rails Perth (P).
				Nitrate.	Ammonia.	Blood and Bone.	Bone Dust.	Water Sol.	Citrate Sol.	Acid Sol.	Total.	Sulphate.	Muriate.	£ s. d.
Potato Manure "A"	60	Sickle	do. do. do.	....	2.50	....	....	12.00	1.25	1.25	14.50	5.00	....	*11 17 2
Potato Manure "B"	61	do.	do. do. do.	....	3.50	....	....	11.00	1.25	1.25	13.50	5.00	....	*12 10 5
Potato Manure "E"	63	do.	do. do. do.	....	3.50	....	....	8.50	1.00	1.00	10.50	8.00	....	*14 1 6
Potato Manure "A"	54	Cresco	Cresco Fertilisers, Ltd.	....	2.50	....	....	12.00	1.25	1.25	14.50	5.00	....	*11 17 2
Potato Manure "B"	55	do.	do. do.	....	3.50	....	....	11.00	1.25	1.25	13.50	5.00	....	*12 10 5
Potato Manure "E"	57	do.	do. do.	....	3.50	....	....	8.50	1.00	1.00	10.50	8.00	....	*14 1 6
Potato Manure "A"	64	Wattle	Wattle Fertiliser Co.	....	2.50	....	....	12.00	1.25	1.25	14.50	5.00	....	*11 17 2
Orchard Manure	7	Mt. Lyell as ML in diamond	Cuming Smith & Mt. Lyell	....	3.50	....	....	11.00	1.25	1.25	13.50	5.00	....	*12 10 5
Do. do.	14	C.S.M.L.	do. do. do.	....	3.50	....	....	11 00	1.25	1 25	13.50	5 00	....	*12 10 5
Do. do.	30	Sickle	do. do. do.	....	3.50	....	....	11.00	1.25	1.25	13.50	5.00	....	*12 10 5
Do. do.	58	Cresco	Cresco Fertilisers, Ltd.	....	3.50	....	....	11.00	1.25	1.25	13.50	5.00	....	*12 10 5
Tomato Manure	15	C.S.M.L.	Cuming Smith & Mt. Lyell	....	3.50	....	....	6.00	0.75	0.75	7.50	12 00	....	*16 3 2
Tobacco Fertiliser	16	do.	do. do. do.	....	3.30	....	....	10.00	1.25	1 25	12 50	5.70	....	*13 0 7
Potato Manure "A"	83	David Gray's	David Gray & Co. Pty. Ltd.	....	2·5	....	....	12·0	1·25	1·25	14·5	5·0	....	7 lb. bags 1s. 8d each.
Potato Manure "A"	87	'Tubal'	Ralite Products	....	2·5	....	....	12·0	1·25	1·25	14·5	5·0	....	
6. Miscellaneous.														
Liquid Fertiliser 10–10–45	36	Nightingale	Wigmores, Ltd.	....	10.00	....	....	10.00	....	....	10.00	5.00	....	15s. per gallon.
Liquid Manure	42	Fauldings	F. H. Faulding & Co.	....	7.50	....	....	5.00	....	....	5.00	3.50	....	
Fertiliser Tablets	66	Summit Growth	L. M. McLeod	....	4.10	....	....	7.00	1.20	0.10	8.30	12.20	....	1s. per box retail.
Plant Food	71	Dawn	Dawn Nurseries	....	5.23	....	....	11 21	1.41	1.46	14.08	....	....	
Lawn Manure	72	do.	do. do.	....	8 54	....	....	9 23	1.36	0.82	11.40	....	....	
Rose Manure	73	do.	do. do.	....	5.90	....	....	10.30	1.52	0.91	12.70	1.64	....	
Bulb and Corm Manure	74	do.	do. do.	....	1.90	....	....	9.20	1.40	0 80	11.40	9.00	....	
Seedling Manure	75	do.	do. do.	....	5.30	....	....	8.75	1 25	1 00	11 00	4.40	....	
Powdered Fertiliser	78	David Gray's	David Gray & Co. Pty. Ltd.	....	5·6	....	....	3·89	....	1·94	5·83	3·2	....	3s. per 7lb. bag
Rose Manure	80	David Gray's	David Gray & Co. Pty. Ltd.	....	5·6	....	....	3·89	....	1·94	5·83	3·2	....	3s. 3d. per 7 lb. bag
Liquid Fertiliser	85	David Gray's	David Gray & Co. Pty. Ltd.	....	9·0	....	....	6·0	....	....	6·0	4·0	....	3s. per 20 oz. bottle
B.—ORGANIC.														
(a) *Blood and Bone.*														
Blood and Bone	24	C.S.M.L.	Cuming Smith & Mt. Lyell	....	....	5.00	....	....	....	12.00	12.00	....	....	11 7 0 (W)
Do.	37	K in diamond A and A Surprise	C. A. Kirkby & Sons	....	....	5.50	....		4.00	10.00	14.00	....	....	15 8 6 (P)
Do.	41	Wyndham	Wyndham Meat Works	....	....	6.00	....	....	6.50	9.00	15.50	....	....	14 16 0 (P)
Do	46	Kitchens	J. Kitchen & Sons	....	....	7.00	....	....	9.00	5.00	14.00	....	....	

Fertiliser "G" (Blood and Bone)	68	Pannifex	Burridge & Warren	..	...	6.25			.	7.25	6.25	13.50	....	....	†12 3 0
Blood and Bone	69	Eclipse ...	The W.A. Meat Export Works		.	6 00	.	.	.	..	12 00	.	...	14 0 0 (W)
Do.	70	Robbs	do. do. do.		.	5 25		.	..	..	14.00	.	....	13 10 0 (W)
Animal Fertiliser	35	Thomas ..	W. Thomas & Co. (W.A.), Ltd.			5.00		..	3.50	2.00	5.50	...	..	10 18 9 (P)
(b) Bone Dust.														
General Purpose Bone Dust	65	Wattle	Wattle Fertiliser Co. .		.		3.43		.		20.57	..	.	
(c) Fish Fertilisers.														
Fish Fertiliser .	40	Cormo	Nor-West Fertiliser Co.			5 00		.			8.00	..	.	
(d) Miscellaneous.														
Garden Fertiliser . ..	39	Sprout-Em	Kag Manufacturing Co. .	.			3.75		5.00	4.00	9 00	....	.	*
C.—MINERAL AND ORGANIC.														
Bone and Superphosphate ...	63	Wattle	Wattle Fertiliser Co. .	.			1 44	8.75	1 25	10.54	20 54	...	.	11 2 6 (P)
Garden Fertiliser	67	Apex (C & R)	W.A. Produce Co. .			5.00				..	9 00	trace		16 10 0 (P)

(W) At Works. (P) Perth. * Cash at Works after deducting Commonwealth Superphosphate Subsidy. † F.O.B. Melbourne.

Notice to Beekeepers

The quarantine service of the Health Department working through its Chief Quarantine Officers (Animals) and Quarantine Officers in each State administers quarantine legislation with respect to bees etc., and this legislation provides that only queen bees and their escorts may be imported from overseas subject to compliance with the following requirements:—

The queen bee and a small escort must be consigned to the Chief Quarantine Officer, Animals, of the State of importation and be accompanied by—

(a) a declaration by the owner stating that they are free from disease and that they are from an apiary that is free from disease and

(b) certification from a Government Veterinary Surgeon or other Officer whose duties relate to Apiculture in the exporting country, certifying that the bees are from a disease free area and that Isle of Wight disease (Acariasis) does not exist in that country or in any apiary within 20 miles of that in which the bees are kept.

Unlike other "animals" listed under the Quarantine Act, bees may be imported by air and in fact this is their usual mode of travel.

On arrival, the cages containing the queens and their escorts are opened one at a time in a glass and gauze cage by a specialist and 15 to 20 of the foreign escorts are selected at random from each cage for dissection and microscopic examination. The queen is examined under a magnifying glass and if she and her escort are found healthy, she is placed in a new cage with a fresh escort and suitable food. The old cage, escort, food, etc., is then burnt and a permit is issued for the release of the queen.

If on the other hand, the bees are found to be diseased they are destroyed by burning together with their cages, food etc.

In 1943, it was found that certain Tasmanian apiaries were infected with *Braula coeca* and for this reason special quarantine conditions were imposed on bee exports from Tasmania to the mainland. These include certification of freedom from disease by a Government Veterinary Surgeon or Apiary Inspector.

The importation of used or second-hand bee hives from overseas is totally prohibited.

These precautions are taken to protect the Australian bee industry against the introduction into this country of *Braula coeca* infestation, Acariasis and Nosema disease which are proclaimed diseases under the Quarantine Act and any other diseases which may endanger the welfare of the Beekeeping Industry.

C.S.I.R. INFORMATION SERVICE.

CHANGE OF ADDRESS.

Readers are advised that the C.S.I.R. Information Service has changed its address and is now located at C.S.I.R. Head Office,

314 ALBERT STREET, EAST MELBOURNE, C.2.

Telephone JA 6611.

ANALYSES OF FEEDING STUFFS.

RESULTS of Analyses of samples of Feeding Stuffs taken under the Feeding Stuffs Act, 1928-1946.

(Published under section 9 of the Act.)

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre	Sodium Chlor.	Phosphoric Acid. P_2O_5.	Lime.	Others.	
		%	%	%	%	%	%	%	%
	David Gray & Co., Pty., Ltd.								
	"Western" Chick Starter –						Ca		
	Registered Analysis	†14.5	†4.0	*4.5		2.0	0.5		
2-8-48	Sample Analysis	13.2	2.8	3.9		1.36	0.73		
	"Western" Chick Builder –								
	Registered Analysis	†14.0	†4.0	*4.5		2.0	0.5		
3-8-48	Sample Analysis	13.2	3.2	3.9		1.49	0.60		
	"Western" "A1" Laying Mash								
	Registered Analysis	†14.0	†3.0	*5.0		2.0	0.5		
2-8-48	Sample Analysis	15.0	3.1	5.3		1.53	0.59		
	"Western" Sweet Dairy Food—								
	Registered Analysis	†12.0	†3.0	*10.0			0.5		
2-8-48	Sample Analysis	10.1	1.51	4.3			0.15		
	W. Thomas & Co. (W.A.) Ltd.								
	"Thomas" Calf Food—								
	Registered Analysis	†15.5	†2.5	*6.5	3.0		15.0		
3-8-48	Sample Analysis	21.7	3.5	6.6	1.08		2.53		
	"Thomas" Laying Mash No. 2—								
	Registered Analysis	†11.0	†2.5	*6.5	1.5		3.75		
2-8-48	Sample Analysis	12.5	2.9	4.8	1.15		1.60		
	Westralian Farmers Co-op. Ltd.								
	"Red Comb" Chick Pellets "A" –								
	Registered Analysis	†15.0	†4.5	*7.0			0.3		
30-7-48	Sample Analysis	15.8	5.1	4.1			1.05		
	"Red Comb" Chick Pellets "B"—								
	Registered Analysis	†14.0	†4.0	*7.0	0.5		0.6		
30-7-48	Sample Analysis	16.2	4.2	3.7	0.64		1.10		
	"Red Comb" Growers Pellets								
	Registered Analysis	†13.0	†4.0	*7.0	0.5		0.7		
30-7-48	Sample Analysis	13.4	3.9	4.0	0.78		1.44		
	"Wesfarmers" Calf Meal –								
	Registered Analysis	†13.0	†3.5	*6.0	less than 1 %		0.5		
30-7-48	Sample Analysis	13.3	3.3	3.3	0.86		0.82		
	Barrow Lanton & Co.								
	"Egglayer" Laying Mash –								
	Registered Analysis	†14.0	†3.5	*4.5	1.0		3.0		
5-8-48	Sample Analysis	17.8	5.1	5.7	0.32		4.08		
	"Eggoleen" –								
	Registered Analysis	†37.5	*12.0	*1.5					
5-8-48	Sample Analysis	42.2	10.7	1.3					
	"Growell" Growing Mash—								
	Registered Analysis	†14.0	†4.5	*4.5	1.0		3.0		
5-8-48	Sample Analysis	18.8	4.8	3.8	0.20		5.62		
	"Vitalizer" Chickstarter –								
	Registered Analysis	†15.0	†4.0	*4.5	1.0		3.0		
5-8-48	Sample Analysis	20.8	4.7	4.1	0.41		4.28		
	David Gray & Co. Pty. Ltd.								
	"Western" Calf Food								
	Registered Analysis	†22.5	†7.0	*5.0		2.0	0.5		
4-8-48	Sample Analysis	21.6	8.6	5.0		0.97	0.28		
	"Western" Chickbuilder								
	Registered Analysis	†1 .0	†4.0	*4.5		2.0	0.5		
3-8-48	Sample Analysis	13.2	3.2	3.9		1.49	0.60		
	"Western" Chickstarter –								
	Registered Analysis	†14.5	†4.0	*4.5		2.0	0.5		
2-8-48	Sample Analysis	13.2	2.8	3.9		1.36	0.73		
	"Western" Egg Food—								
	Registered Analysis	†80.0	†10.0	*4.0			0.5		
18-8-48	Sample Analysis	80.4	7.9	4.1			1.58		
	"Western" Lin Meal—								
	Registered Analysis	†22.5	†7.0	*5.0			0.5		
18-8-48	Sample Analysis	21.4	5.4	5.0			0.35		
	"Western" Laying Mash "B"								
	Registered Analysis	†12.5	†3.0	*5.0		2.00	0.5		
3-8-48	Sample Analysis	12.8	3.1	3.9		0.85	0.08		

*Maximum. † Minimum

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid. P_2O_5.	Lime.	Others.	
		%	%	%	%	%	%	%	%
	David Gray & Co., Pty., Ltd.								
	" Western " A1 Laying Mash—								
	Registered Analysis	†14 0	†3.0	*5.0	.	2.0	0.5	.	
2-8-48	Sample Analysis	15 0	3.1	5 3	..	1.53	0.59		
	" Western " Sweet Dairy Food—								
	Registered Analysis	†12 0	†3 0	*10.0			0.5		
2-8-48	Sample Analysis	10 1	1 51	4.3		.	0 15		
	W. Thomas & Co. (W.A.), Ltd								
	" Thomas " Calf Food—								
	Registered Analysis	†15 5	†2 5	*6 5	*3 0		*15.0		.
3-8-48	Sample Analysis	21 7	3 5	6 6	1 08		2 53		.
	" Thomas " Chicken Grain—								
	Registered Analysis	†9 0	†1 5	*4 5			.		
19-8-48	Sample Analysis	8 9	1 4	1 7					
	" Thomas " Egg Protein—								
	Registered Analysis	†42 0	*15 0	*4 5	*8 5		15.0		
4-8-48	Sample Analysis	44 6	12 6	0 6	5.26	.	9.57		
	" Thomas " Quicklay—								
	Registered Analysis	†35 0	*12 5	*4 0	*3 0		15 0		
18-8-48	Sample Analysis	36 2	11 2	1.4	1 67	.	11.6	.	
	" Thomas " Laying Mash No. 1—								
	Registered Analysis	†14.0	†2 5	*6.0	*1 5		*3 75		
4-8-48	Sample Analysis	15.8	4.1	5 1	1.06		2.66		
	" Thomas " Sweet Dairy Food—								
	Registered Analysis	†11 5	†1 5	*8 5	*1 75	.	*4.0		
3-8-48	Sample Analysis	13 1	3 1	6 0	2.19		1 71		.
	" Thomas " Laying Mash No. 2—								
	Registered Analysis	†11 0	†2 5	*6 5	1 5		3 75		
2-8-48	Sample Analysis	12 5	2 9	4 8	1 15		1 60		
	W.A. Meat Export Works.								
	" W.A.M.E." Bonemeal—						CaO		
	Registered Analysis	†18 75			*0 25	†26.0	†27.0		...
23-7-48	Sample Analysis	24 0			0 15	25 1	33.3		.
	" W.A.M.E. Meatmeal—								
	Registered Analysis	†45 0	*13 0	*2.0				.	
23-7-48	Sample Analysis	44 2	13.7	1.9					
	" W.A.M.E " Bonemeal—								
	Registered Analysis	†18 75			0 25	†26 0	†27 0		
19-8-48	Sample Analysis	24 3			0 18	24.9	33 8		.
	Westralian Farmers Co-op., Ltd								
	" Red Comb " Chick Pellets " A "								
	Registered Analysis	†15 0	†4 0	*7 0		.	0 3		..
30-7-48	Sample Analysis	15.8	5 1	4 1			1 05		
	" Red Comb" Chick Pellets " B" -								
	Registered Analysis	†14 0	†4 0	*7 0	0 5	.	0 5		.
30-7-48	Sample Analysis	16 2	4.2	3 7	0.64		1.10	..	.
	" Wesfarmers " Calf Meal-								
	Registered Analysis	†13.0	†3.5	*6 0	Less than 1	....	0 5		..
30-7-48	Sample Analysis	13 3	3.3	3.3	0.86	.	0.82		.
	" Red Comb " Growers Pellets—								
	Registered Analysis	†13 0	†4 0	*7.5	0 5		0.7	..	....
30-7-48	Sample Analysis	13.4	3 9	4 0	0.78		1 44		..
	" Wesfarmers " Laying Mash No. 1—								
	Registered Analysis	†14 0	†4 0	*7.0	0.5	.	1.0		...
4-8-48	Sample Analysis	15 5	3 7	3 9	1.06		2.42	..	.
	" Red Comb " Laying Pellets No. 1—			.			$CaCO_3$		
	Registered Analysis .	†14 0	†4 0	*7 0	0.5		†2.5	.	...
23-7-48	Sample Analysis	13 8	3.8	3.5	0.43		2.57	.	.
	" Wesfarmers " Protein Meal " B "—								
	Registered Analysis ..	†35.0	*10.0	*4.5			†15 0		
23-7-48	Sample Analysis	34.3	5.9	0.8			17.89		
	R. B. Young.								
	" Morlay " Chick Allmash—						Ca		
	Registered Analysis .	†12 5	†3 0	*5 5	*1.5	*3.5	†2.0		....
20-8-48	Sample Analysis	13 4	2.7	2 5	0.75	2.70	4.03		...

* Maximum. † Minimum.

ANALYSES OF FEEDING STUFFS—*continued.*

Date Sample taken.	Firm and Brand.	Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chlor.	Phosphoric Acid. P_2O_5.	Lime.	Others.	
		%	%	%	%	%	%	%	%
	R. B. Young.								
	" Morlay " Chickstarter—								
	Registered Analysis	†15.0	†3.0	*5.5	*1.5	*3.5	†2.5		
20-8-48	Sample Analysis	15.0	3.2	3.7	1.02	2.45	3.98		
	" Morlay " Fattening Mash " D "								
	Registered Analysis	†10.5	†3.0	*5.0	*1.5	*3.5	†2.0		
20-8-48	Sample Analysis	12.4	3.1	4.1	0.22	2.10	2.39		
	" Morlay " Growing Mash—								
	Registered Analysis	†12.5	†3.0	*5.5	*1.5	*4.0	†2.5		
26-7-48	Sample Analysis	11.5	3.2	3.6	1.02	2.84	4.58		
	" Morlay " Laying Allmash—								
	Registered Analysis	†13.0	†3.0	*6.0	*1.5	*4.0	†2.5		
26-7-48	Sample Analysis	12.8	4.3	3.1	1.29	3.59	3.63		
	" Morlay " Laying Mash—								
	Registered Analysis	†14.0	†3.0	*5.5	*1.5	*3.5	†2.5		
26-7-48	Sample Analysis	13.6	4.2	3.6	0.87	3.54	3.98		

* Maximum. † Minimum.